

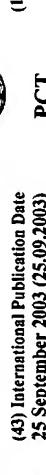
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(71) Inventor(s)/Applicant(s) (for US only): GOULIAEV, Y.

(71) Inventor(s)/Applicant(s) (for US only): GOULIAEV, Y.

(72) Inventor(s) and

(72) Inventor(s) and

(73) Inventor(s)/Applicant(s) (for US only): Sjælland (DK), HO, Justina (USDK); Matheusgade 50, 3-26, DK-1666 København V (DK). FELDING, Jakob [DK/DK]; Ordrupgårdsvæj 24, 1., DK-2920 Charlottenlund (DK). SAMS, Christian [DK/DK]; Jacob Dannerdævesvej 4A, 1., DK-1973 Frederiksberg C (DK). PEDERSEN, Henik [DK/DK]; Frødesvej 24, DK-2880 Bagsværd (DK). JENSEN, Klem, Birkebæk [DK/DK]; Voldumvej 30C, DK-2610 Ræslove (DK). HANSEN, Anders, Holm

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Title
A BUILDING BLOCK CAPABLE OF TRANSFERRING A FUNCTIONAL ENTITY

Technical Field of the Invention

The present invention relates to a building block comprising a complementing element and a precursor for a functional entity. The building block is designed to transfer the functional entity with an adjustable efficiency to a recipient reactive group upon recognition between the complementing element and an encoding element associated with the reactive group. The invention also relates to a linkage between the functional entity and the complementing element as well as a method for transferring a functional entity to recipient reactive group.

Background

The transfer of a chemical entity from one mono-, di- or oligonucleotide to another has been considered in the prior art. Thus, N. M. Chung *et al.* (Biochim. Biophys. Acta, 1971, 228, 536-543) used a poly(U) template to catalyse the transfer of an acetyl group from 3'-O-acetyladenosine to the 5'-OH of adenosine. The reverse transfer, i.e. the transfer of the acetyl group from a 5'-O-acetyladenosine to a 3'-OH group of another adenosine, was also demonstrated.

Walder *et al.* Proc. Natl. Acad. Sci. USA, 1979, 76, 51-55 suggest a synthetic procedure for peptide synthesis. The synthesis involves the transfer of nascent immobilized polypeptide attached to an oligonucleotide strand to a precursor amino acid attached to an oligonucleotide. The transfer comprises the chemical attack of the amino group of the amino acid precursor on the substitution labile peptidyl ester, which in turn results in an acyl transfer. It is suggested to attach the amino acid precursor to the 5' end of an oligonucleotide with a thiol ester linkage.

The transfer of a peptide from one oligonucleotide to another using a template is disclosed in Bruylants RK *et al.* Chemistry & Biology, 1996, 3:49-56. The carboxy terminal of the peptide is initially converted to a thioester group and subsequently transformed to an activated thioester upon incubation with Ellman's reagent. The activated thioester is reacted with a first oligo, which is 5'-thiol-terminated, resulting in the formation of a thio-ester linked intermediate. The first oligonucleotide and a second oligonucleotide having a 3' amino group is aligned on a template such that

(57) **Abstract:** A building block having the dual capabilities of transferring the genetic information e.g. by recognising an encoding element and transferring a functional entity to a recipient reactive group is disclosed. The building block can be designed with an adjustable transference taking into account the components of the building block. The building block may be used in the generation of a single complex or libraries of different complexes, wherein the complex comprises an encoded molecule linked to an encoding element. Libraries of complexes are useful in the quest for pharmaceutically active compounds.

2

the thioester group and the amino group are positioned in close proximity and a reaction is effected resulting in a coupling of the peptide to the second oligonucleotide through an amide bond.

- 5 In an aspect of the present invention a storable oligonucleotide conjugated to a transferable chemical moiety is provided. In another aspect of the invention an oligonucleotide conjugate which is possible to prepare in a few steps is provided. In yet another aspect an arsenal of possibilities for adjusting the transferability of a chemical moiety is provided. Adjusting the transferability of a chemical moiety may prove crucial in obtaining specific reactions.

Summary of the Invention

The present invention relates to a building block of the general formula

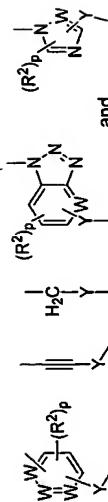
15 Complementing Element – Linker – Carrier – C-F-connecting group – Functional entity precursor

capable of transferring a functional entity to a recipient reactive group, wherein

Complementing Element is a group identifying the functional entity precursor,

Linker is a chemical moiety comprising a Spacer and a S-C-connecting group, wherein the Spacer is a valence bond or a group distancing the functional entity precursor to be transferred from the complementing element and the S-C-connecting group connects the spacer with the Carrier,

Carrier is selected among the groups



wherein the Linker attaches to the Carrier through Y and

W = CH or N

30 $R^2 = -H, -Halogen, -NO_2, -CN, -C(Halogen)_3, -C(O)R^3, -C(O)NR^3, C(O)NR^2, -NC(O)R^3, -S(O)NHR^3, -S(O)_2NR^3, -S(O)_2R^3, -P(O)zR^3, -P(O)-R^3, -S(O)-R^3, P(O)-OR^3, -S(O)-OR^3, -NR^3, \text{ wherein } p \text{ is an integer of 0 to 3, } R^3 = H, C_1-C_6 \text{ alkyl, } C_1-C_6 \text{ alkenyl, } C_1-C_6 \text{ alkynyl, or aryl, and Halogen is F, Cl, Br, or I,}$

3

$Y = \text{absent, } C_1-C_6 \text{ Alkylene, } C_1-C_6 \text{ Alkenylene, } C_1-C_6 \text{ Alkyne, Arylene, Het-}$
eroarylene, Carbonyl, or $-SO_2CH_2-$,



C-F-connecting group is — $Z-X-$ or $-X-$ where the carrier is connected to

the left hand side of the formulae and

5 $X = -O-, -S-, -P-, -S(O)-$ or $-P(O)-,$
 $V = O, S, NH, \text{ or } NC_1-C_6 \text{ alkyl, and}$
 $Z = O, S, \text{ and}$

Functional entity precursor is H or selected among the group consisting of a C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_7 cycloalkenyl, C_3-C_7 cycloalkyl, C_3-C_7 cycloheteroalkenyl, aryl, and heteroaryl, said group being substituted with $0-3 R^4, 0-3 R^5$ and $0-3 R^6$, or selected among the group consisting of C_1-C_3 alkylene- NR^4_2, C_1-C_3 alkylene- $NR^4C(O)R^6, C_1-C_3$ alkylene- NR^4_2, C_1-C_2 alkylene- $O-NR^4_2, C_1-C_2$ alkylene- $O-NR^4C(O)R^6$, and C_1-C_2 alkylene- $O-NR^4C(O)OR^6$ substituted with $0-3 R^7$.

where R^4 is H or selected independently among the group consisting of C_1-C_6 alkyli, C_2-C_6 alkenyli, C_2-C_6 alkynyl, C_3-C_7 cycloalkyli, C_3-C_7 cycloheteroalkyli, aryl, and heteroaryl, said group being substituted with $0-3 R^8$ and

R^5 is selected independently from $-N_3, -CNO, -C(NOH)NH_2, -NHCOH, -NNHNHR^6, -C(O)R^6, -SnR^3, -B(OR^6)_2, -P(O)(OR^6)_2$ or the group consisting of C_2-C_6 alkene, C_2-C_6 alkyli, C_2-C_6 alkadienyl, said group being substituted with $0-2 R^7$, where R^6 is selected independently from H, C_1-C_6 alkyl, C_3-C_7 cycloalkyl, aryl or C_1-C_6 alkylene-aryl substituted with 0-5 halogen atoms selected from $-F, -Cl, -Br, -I$; and R^7 is independently selected from $-NO_2, -COOR^6, -COR^6, -CN, -OSiR^6_3, -OR^6$ and $-NHR^6_2$.

10 15 R^6 is H, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_7 cycloalkyl, aryl or C_1-C_6 alkyli, C_2-C_6 alkenyli, C_2-C_6 alkynyl, C_3-C_7 cycloalkyli, C_3-C_7 cycloheteroalkyli, aryl, and heteroaryl, said group being substituted with $0-3 R^8$ and

R^7 is $=O, -F, -Cl, -Br, -I, -CN, -NO_2, -OR^6, -NR^6-C(O)OR^6, -NR^6-C(O)NR^6, -SR^6, -S(O)R^6, -S(O)_2R^6, -COOR^6, -COR^6, -CN, -OSiR^6_3$.

20 25 In the present description and claims, the direction of connections between the various components of a building block should be read left to right. For example an S-C-connecting group $-C=O-NH-$ is connected to a spacer through the carbon atom on the left and to a carrier through the nitrogen atom on the right hand side.

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4

The term "C₃-C₇ cycloheteroalkyl" as used herein refers to a radical of totally saturated heterocycle like a cyclic hydrocarbon containing one or more heteroatoms selected from nitrogen, oxygen, phosphor, boron and sulphur independently in the cycle such as pyrrolidine (1-pyrrolidine; 2-pyrrolidine; 3-pyrrolidine; 4-pyrrolidine; 5-pyrrolidine); pyrazolidine (1-pyrazolidine; 2-pyrazolidine; 3-pyrazolidine; 4-pyrazolidine; 5-pyrazolidine); imidazolidine (1-imidazolidine; 2-imidazolidine; 3-imidazolidine; 4-imidazolidine; 5-imidazolidine); thiazolidine (2-thiazolidine; 3-thiazolidine; 4-thiazolidine; 5-thiazolidine); piperidine (1-piperidine; 2-piperidine; 3-piperidine; 4-piperidine; 5-piperidine); piperazine (1-piperazine; 2-piperazine; 3-piperazine; 4-piperazine; 5-piperazine; 6-piperazine); morpholine (2-morpholine; 3-morpholine; 4-morpholine; 5-morpholine; 6-morpholine); thiomorpholine (2-thiomorpholine; 3-thiomorpholine; 4-thiomorpholine; 5-thiomorpholine; 6-thiomorpholine); 1,2-oxathiolane (3-(1,2-oxathiolane); 4-(1,2-oxathiolane); 5-(1,2-oxathiolane); 1,3-dioxolane (2-(1,3-dioxolane); 4-(1,3-dioxolane); 5-(1,3-dioxolane); tetrahydropyran; (2-tetrahydropyran; 3-tetrahydropyran; 4-tetrahydropyran; 5-tetrahydropyran; 6-tetrahydropyran); hexahydropyridazine (1-(hexahydropyridazine); 2-(hexahydropyridazine); 3-(hexahydropyridazine); 4-(hexahydropyridazine); 5-(hexahydropyridazine); 6-(hexahydropyridazine)); [1,3,2]dioxaborolane, [1,3,6,2]tetraoxaborocane.

The term "any" as used herein includes carbocyclic aromatic ring systems of 5-7 carbon atoms. Aryl is also intended to include the partially hydrogenated derivatives of the carbocyclic systems as well as up to four fused aromatic- or partially hydrogenated rings, each ring comprising 5-7 carbon atoms.

The term "heteroaryl" as used herein includes heterocyclic unsaturated ring systems containing, in addition to 2-18 carbon atoms, one or more heteroatoms selected from nitrogen, oxygen and sulphur such as furyl, thieryl, pyrrolyl, heteroaryl is also intended to include the partially hydrogenated derivatives of the heterocyclic systems enumerated below.

The terms "any" and "heteroaryl" as used herein refers to an aryl which can be optionally substituted or a heteroaryl which can be optionally substituted and includes phenyl, biphenyl, indenyl, naphthyl (1-naphthyl, 2-naphthyl), N-hydroxytetrazoyl, N-hydroxytriazoyl, N-hydroxymimidazoyl, anthracenyl (1-anthracenyl, 2-anthracenyl, 3-anthracenyl), thiophenyl (2-thienyl, 3-thienyl), furyl (2-furyl, 3-furyl), indoyl, oxadiazoyl, isoxazoyl, quinazolinyl, fluorenyl, xantheny.

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isoindanyl, benzhydryl, acridinyl, thiazoyl, pyrrolyl (2-pyrrolyl), pyrazoyl (3-pyrazoyl), imidazoyl (1-imidazoyl, 2-imidazoyl, 4-imidazoyl, 5-imidazoyl), triazoyl (1,2,3-triazol-1-yl, 1,2,3-triazol-2-yl, 1,2,3-triazol-4-yl, 1,2,4-triazol-3-yl), oxazoyl (2-oxazoyl, 4-oxazoyl, 5-oxazoyl), thiazoyl (2-thiazoyl, 4-thiazoyl, 5-thiazoyl), pyridyl (2-pyridyl, 3-pyridyl, 4-pyridyl), pyrimidinyl (2-pyrimidinyl, 4-pyrimidinyl, 5-pyrimidinyl, 6-pyrimidinyl, 8-pyrimidinyl), pyrazinyl, pyridazinyl (3-pyridazinyl, 4-pyridazinyl, 5-pyridazinyl), quinolyl (2-quinolyl, 3-quinolyl, 4-quinolyl, 5-quinolyl, 6-quinolyl, 7-quinolyl, 8-quinolyl), isoquinolyl (1-isoquinolyl, 3-isoquinolyl, 4-isoquinolyl, 5-isoquinolyl, 6-isoquinolyl, 7-isoquinolyl), 8-isquinolyl), benzo[b]furanyl (2-benzo[b]furanyl, 3-benzo[b]furanyl, 4-benzo[b]furanyl, 5-benzo[b]furanyl, 6-benzo[b]furanyl, 7-benzo[b]furanyl), 2,3-dihydro-benzol[b]furanyl (2,3-dihydro-benzol[b]furanyl, 2,3-dihydro-benzol[b]furanyl, 5-(2,3-dihydro-benzol[b]furanyl), 6-(2,3-dihydro-benzol[b]furanyl), 8-(2,3-dihydro-benzol[b]furanyl), 2-(2,3-dihydro-benzol[b]furanyl), 3-(2,3-dihydro-benzol[b]furanyl), 4-(2,3-dihydro-benzol[b]furanyl), 5-(2,3-dihydro-benzol[b]furanyl), 6-(2,3-dihydro-benzol[b]furanyl), 7-(2,3-dihydro-benzol[b]furanyl), benzol[b]thiophenyl (2-benzol[b]thiophenyl, 3-benzol[b]thiophenyl, 4-benzol[b]thiophenyl, 5-benzol[b]thiophenyl, 6-benzol[b]thiophenyl, 7-benzol[b]thiophenyl), 2,3-dihydro-benzol[b]thiophenyl (2,3-dihydro-benzol[b]thiophenyl), 3-(2,3-dihydro-benzol[b]thiophenyl), 4-(2,3-dihydro-benzol[b]thiophenyl), 5-(2,3-dihydro-benzol[b]thiophenyl), 6-(2,3-dihydro-benzol[b]thiophenyl), 7-(2,3-dihydro-benzol[b]thiophenyl), indolyl (1-indolyl, 2-indolyl, 3-indolyl, 4-indolyl, 6-indolyl, 7-indolyl), indazole (1-indazolyl, 2-indazolyl, 3-indazolyl, 4-indazolyl, 5-indazolyl, 6-indazolyl, 7-indazolyl), benzimidazolyl (1-benzimidazolyl, 2-benzimidazolyl, 4-benzimidazolyl, 5-benzimidazolyl, 6-benzimidazolyl, 7-benzimidazolyl, 8-benzimidazolyl), benzoxazolyl (1-benzoxazolyl, 2-benzoxazolyl), benzothiazolyl (1-benzothiazolyl, 2-benzothiazolyl), carbazolyl (1-carbazolyl, 2-carbazolyl, 3-carbazolyl, 4-carbazolyl, 5H-dibenz[b,f]azepine (5H-dibenz[b,f]azepin-1-yl, 5H-dibenz[b,f]azepin-2-yl, 5H-dibenz[b,f]azepin-3-yl, 5H-dibenz[b,f]azepine-4-yl, 5H-dibenz[b,f]azepine-5-yl), 10,11-dihydro-5H-dibenz[b,f]azepines (10,11-dihydro-5H-dibenz[b,f]azepine-1-yl, 10,11-dihydro-5H-dibenz[b,f]azepine-2-yl, 10,11-dihydro-5H-dibenz[b,f]azepine-3-yl, 10,11-dihydro-5H-dibenz[b,f]azepine-4-yl, 10,11-dihydro-5H-dibenz[b,f]azepine-5-yl).

The Functional Entity carries elements used to interact with host molecules and optionally reactive elements allowing further elaboration of an encoded molecule of a library. Interaction with host molecules like enzymes, receptors and polymers is typi-

6
cally mediated through van der waal's interactions, polar- and ionic interactions and pi-stacking effects. Substituents mediating said effects may be masked by methods known to an individual skilled in the art (Greene, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*; 3rd ed.; John Wiley & Sons: New York, 1999.) to avoid undesired interactions or reactions during the preparation of the individual building blocks and during library synthesis. Analogously, reactive elements may be masked by suitably selected protection groups. It is appreciated by one skilled in the art that by suitable protection, a functional entity may carry a wide range of substituents.

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The Functional Entity Precursor may be masked Functional Entity that is incorporated into an encoded molecule. After incorporation, reactive elements of the Functional Entity may be revealed by un-masking allowing further synthetic operations. Finally, elements mediating recognition of host molecules may be un-masked.

15
The function of the carrier is to adjust the transferability of the functional entity, playing the role of a leaving group. Substituents on the carrier after the leaving group efficiency. The stronger the electron withdrawing effect the easier the functional entity is cleaved from the remainder of the building block. However the cleavage can occur too fast which will result in unspecific transfer or hydrolysis. To adjust the transferability a skilled chemist can design suitable substitutions of the carrier by evaluation of initial attempts. The transferability may be adjusted in response to the chemical composition of the functional entity, to the nature of the complementing element, to the conditions under which the transfer and recognition is performed, ect.

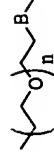
According to a preferred embodiment of the invention the carrier is of the general formula:

$$\begin{array}{c} \text{H}_3\text{C} \\ | \\ \text{W}-\text{C}=\text{C}-\text{R}^2 \\ | \\ \text{W}-\text{C}=\text{C}-\text{R}^2_p \\ | \\ \text{Y} \end{array}$$

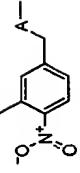
30
wherein W, Y, R², and p are as defined above. The transferability of the functional entity can be adjusted by suitable selection of the ring member. When the identity of W are fixed the transferability of the carrier may be adjusted by selecting type, position and amount of the ring substituents R². As an example, an unsubstituted benz-

7
zeno ring (W = CH for the entire ring structure) may be provided with an increased ability to transfer a functional entity by attaching a Cl in the *ortho* position. The ability to transfer functional entities may also be adjusted by proper selection of one, two or three nitrogen atoms in the ring structure. Finally, the identity and position of Y or alternatively the S-C-connecting group may have an influence of the transferability of the functional entity. Thus, attaching a carbonyl at the *para* position of the ring structure relative to the attachment point of the functional C-F-connecting group confers an increased ability to transfer the functional entity over a position in e.g. the *meta* position.

- 10
In a preferred aspect of the invention the carrier is
- $$\begin{array}{c} \text{W}-\text{C}=\text{C}-\text{R}^2 \\ | \\ \text{W}-\text{C}=\text{C}-\text{R}^2_p \\ | \\ \text{Y} \end{array}$$
- 15
and attaches to the linker through Y and
- 15
W = CH
R² = -H, halogen, NO₂, -CN, -(O)Halogen)₃, -C(O)NR³, C(O)NR³,
-S(O)NR³, -(S(O)₂)_pR³, -N⁺R³₂, wherein halogen is selected from the group consisting of -Cl, -F, -Br, and -I, p is an integer of 0 to 3, and R³ = H, C₁-C₆ alkyl, or aryl,
- 20
Y = absent, C₁-C₆ Alkylen, or carbonyl.
- 25
The spacer serves to distance the functional entity to be transferred from the bulky complementing element. Thus, when present, the identity of the spacer is not crucial for the function of the building block. It may be desired to have a spacer which can be cleaved by light. In this occasion, the spacer is provided with e.g. the group
- $$\begin{array}{c} \text{O}^+ \\ || \\ \text{N}^+ - \text{C}_6\text{H}_4 - \text{CH}_2 - \text{A} - \text{CH}_2 - \text{C}_6\text{H}_4 - \text{N}^+ - \text{O}^- \end{array}$$
- 30
In the event an increased hydrophilicity is desired the spacer may be provided with a polyethylene glycol part of the general formula:



In a certain aspect of the invention the Spacer is a valence bond, C₁-C₆ alkylene-A-, or C₁-C₆ alkenylene-A-, or C₂-C₆ alkynylene-A-, or



said spacer optionally being connected through A to a linker selected from



—(CH₂)_n—S—S—(CH₂)_m—B—,

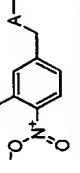
where A is —C(O)NR¹, —NR¹, —O, —S, or —C(O)O; B is —O, —S, —NR¹, or —

C(O)NR¹; and connects to S-C-connecting group; R¹ is selected independently from H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₁-C₆ alkylene-aryl, or aryl substituted with 0-5 halogen atoms selected from -F, -Cl, -Br and -I; and n and m independently are integers ranging from 1 to 10.

More preferred the Spacer is C₁-C₆ alkenylene-A-, C₁-C₆ alkynylene-A-, C₂-C₆ alkyne-A-, or



said spacer optionally being connected through A to a moiety selected from



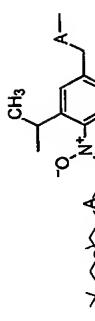
—(CH₂)_n—S—S—(CH₂)_m—B—,

where A is —C(O)NR¹, or —S; B is —S, —NR¹, or —C(O)NR¹; and connects to S-C-

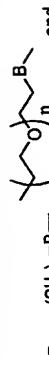
connecting group; R¹ is selected independently from H, C₁-C₆ alkyl, C₁-C₆ alkyne-aryl, or aryl; and n and m independently are integers ranging from 1 to 6.

In certain other aspects of the invention the Spacer is -A-, a group C₁-C₆ alkyne-A-, C₂-C₆ alkynylene-A-, or C₂-C₆ alkynylene-A- optionally substituted with 1 to 3 hydroxy groups, or

9



said spacer being connected through A to a linker selected from



—(CH₂)_n—S—S—(CH₂)_m—B—,

where A is a valence bond, —NR¹⁰, —C(O)NR¹⁰, —NR¹⁰—C(O), —O, —S, —C(O)O- or —OP(=O)(O)O; B is a valence bond, —O, —S, —NR¹⁰, —C(O) or —C(O)NR¹⁰ and connects to S-C-connecting group; R¹⁰ is selected independently from H, C₁-C₆ al-

yl, C₃-C₇ cycloalkyl, aryl, C₁-C₆ alkylene-aryl, G, or G; n or m, G is H or

C₁-C₆ alkyl; and n and m independently are integers ranging from 1 to 10.

In a preferred aspect of the invention, the spacer is C₂-C₆ alkynylene-A-,

said spacer being connected through A to a moiety selected from



—(CH₂)_n—S—S—(CH₂)_m—B—,

where A is a valence bond, —C(O)NR¹⁰, —NR¹⁰—C(O), —S, —C(O)O- or —OP(=O)(O)

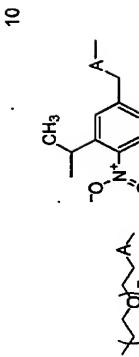
O; B is a valence bond, —S, —NR¹⁰, —C(O) and connects to S-C-connecting group; n and m independently are integers ranging from 1 to 10 and

R¹⁰ is selected independently from H, —O—G, —G—O—, wherein G is H or C₁-C₆ alkyl; and the spacer is connected to the complementing element through a nucleobase.

20

Usually, the spacer connects to the 5 position of a pyrimidine or the 7 position of a purine or deaza-purine. However, other attachment point on the nucleobase may be contemplated.

In another preferred aspect the spacer connects to the back bone of the complementing element. In this case the spacer is -A-,



said spacer being connected through A to a moiety selected from



-B-, —(CH₂)_n-B—, or

where A is a valence bond, -NR¹⁰-C(O)-, O-, or S-, B is a valence bond, -S-

-NR¹⁰-, or -C(O)- and connects to S-C-connecting group;

n and m independently are integers ranging from 1 to 10 and



R¹⁰ is selected independently from H, —O_n or —V_n, wherein G is H or C₁-C₆ alkyl; and the spacer is connected to the complementing element via a phosphorus group.

The phosphorus group is preferably a phosphate or a thiophosphate group attached to a 3' or a 5' end of a complementing element.

In a preferred embodiment, the complementing element serves the function of transferring genetic information e.g. by recognising a coding element. The recognition implies that the two parts are capable of interacting in order to assemble a complementing element – coding element complex. In the biotechnological field a variety of interacting molecular parts are known which can be used according to the invention. Examples include, but are not restricted to protein-protein interactions, polysaccharide interactions, RNA-protein interactions, DNA-DNA interactions, DNA-RNA interactions, RNA-RNA interactions, biotin-streptavidin interactions, enzymeligand interactions, antibody-ligand interaction, protein-ligand interaction, etc.

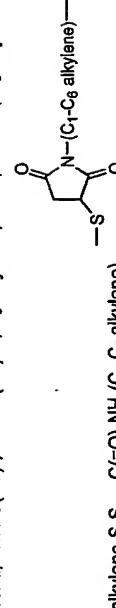
The interaction between the complementing element and coding element may result in a strong or a weak bonding. If a covalent bond is formed between the parties of the affinity pair the binding between the parts can be regarded as strong, whereas the establishment of hydrogen bondings, interactions between hydrophobic domains, and metal chelation in general results in weaker bonding. In general relatively weak bonding is preferred. In a preferred aspect of the invention, the complementing element is capable of reversible interacting with the coding element so as to

provide for an attachment or detachment of the parts in accordance with the changing conditions of the media.

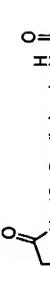
- In a preferred aspect of the invention, the interaction is based on nucleotides, i.e. the complementing element is a nucleic acid. Preferably, the complementing element is a sequence of nucleotides and the coding element is a sequence of nucleotides capable of hybridising to the complementing element. The sequence of nucleotides carries a series of nucleobases on a backbone. The nucleobases may be any chemical entity able to be specifically recognized by a complementing entity. The nucleobases are usually selected from the natural nucleobases (adenine, guanine, uracil, thymine, and cytosine) but also the other nucleobases obeying the Watson-Crick hydrogen-bonding rules may be used, such as the synthetic nucleobases disclosed in US 6,037,120. Examples of natural and non-natural nucleobases able to perform a specific pairing are shown in Figure 2. The backbone of the sequence of nucleotides may be any backbone able to aggregate the nucleobases is a sequence. Examples of backbones are shown in figure 4. In some aspects of the invention the addition of non-specific nucleobases to the complementing element is advantageous, figure 3.
- 5 The coding element can be an oligonucleotide having nucleobases which complement and is specifically recognised by the complementing element, i.e. in the event the complementing element contains cytosine, the coding element part contains guanine and visa versa, and in the event the complementing element contains thymine or uracil the coding element contains adenine.
- 10 The complementing element may be a single nucleobase. In the generation of a template-directed molecule. However, to obtain a higher diversity a complementing element preferably comprises at least two and more preferred at least three nucleotides. Theoretically, this will provide for 4² and 4³, respectively, different functional entities uniquely identified by the complementing element. The complementing element will usually not comprise more than 100 nucleotides. It is preferred to have complementing elements with a sequence of 3 to 30 nucleotides.
- 15 The spacer part of the linker is attached to the carrier through a S-C-connecting group (short for Spacer-Carrier-connecting group). The S-C-connecting may have any chemical composition which provides for an attachment of the Spacer with the

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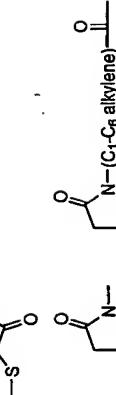
carrier. In certain aspect of the invention the S-C-connecting group is a valence bond, -NH-C(=O)-, -NH-C(=O)-NH-(C₁-C₆ alkylene), -S-S-, -S-S-C₁-C₆ alkylene, -S-C₁-C₆ alkylene, -S-C(=O)-, -NH-C(=O)-NH-(C₁-C₆ alkylene), -C(=O)-N-(C₁-C₆ alkylene)-



5 -NH-C(=O)-NH-(C₁-C₆ alkylene)-, -C(=O)-N-(C₁-C₆ alkylene)-



5 -NH-C(=O)-NH-(C₁-C₆ alkylene)-, -C(=O)-N-(C₁-C₆ alkylene)-



5 -NH-C(=O)-NH-(C₁-C₆ alkylene)-, -C(=O)-N-(C₁-C₆ alkylene)-

10 In a preferred aspect the S-C-connecting group is -S-S-, -C₁-C₆ alkylene-S-S-, -NH-C(=O)-Arylene-C(R¹⁰)₂-NH-C(=O)-, -C(=O)-C₁-C₆ alkylene- or -C(=O)-Arylene-C(R¹⁰)₂-NR¹⁰-C(=O)-, where the right hand side of the formulae connects to the carrier.

15 In a still more preferred aspect the S-C-connecting group is a valence bond, -NH-C(=O)-, -S-S-, or -C(=O)-NH-, where the right hand side of the formulae connects to the carrier.

10 In a preferred aspect the S-C-connecting group is -S-S-, -C₁-C₆ alkylene-S-S-, -C(=O)-NH-(C₁-C₆ alkylene)-, -C(=O)-, or -C(=O)-Arylene-C(R¹⁰)₂-NR¹⁰-C(=O)-, where the right hand side of the formulae connects to the carrier.

15 In a still more preferred aspect the S-C-connecting group is a valence bond, -NH-C(=O)-, -S-S-, or -C(=O)-NH-, where the right hand side of the formulae connects to the carrier.

The building blocks of the present invention can be used in a method for transferring a functional entity to a recipient reactive group, said method comprising the steps of providing one or more building blocks as described above and contacting the one or more building blocks with a corresponding encoding element associated with a recipient reactive group under conditions which allow for a recognition between the one or more complementing elements and the encoding elements, said contacting being performed prior to, simultaneously with, or subsequent to a transfer of the functional entity to the recipient reactive group.

20 The encoding element may comprise one, two, three or more codons, i.e. sequences that may be specifically recognised by a complementing element. Each of

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the codons may be separated by a suitable spacer group. Preferably, all or at least a majority of the codons of the template are arranged in sequence and each of the codons are separated from a neighbouring codon by a spacer group. Generally, it is preferred to have more than two codons on the template to allow for the synthesis of more complex encoded molecules. In a preferred aspect of the invention the number of codons of the encoding element is 2 to 100. Still more preferred are encoding elements comprising 3 to 10 codons. In another aspect, a codon comprises 1 to 50 nucleotides and the complementing element comprises a sequence of nucleotides complementary to one or more of the encoding sequences.

10 The recipient reactive group may be associated with the encoding element in any appropriate way. Thus, the reactive group may be associated covalently or non-covalently to the encoding element. In one embodiment the recipient reactive group is linked covalently to the encoding element through a suitable linker which may be separately cleavable to release the reaction product. In another embodiment, the reactive group is coupled to a complementing element, which is capable of recognising a sequence of nucleotides on the encoding element, whereby the recipient reactive group becomes attached to the encoding element by hybridisation. Also, the recipient reactive group may be part of a chemical scaffold, i.e. a chemical entity having one or more reactive groups available for receiving a functional entity from a building block.

15 The recipient reactive group may be any group able to cleave the C-F-connecting group to release the functional entity. Usually, the reactive group is an amine such as a hydroxyl, a thiol, an amine etc. A preferred recipient reactive group is an amine group. The nucleophile usually attacks the C-F-connecting group between Z and X=V or between the carrier and X=V, thereby causing the carrier group with an optional Z group to be the leaving group of the reaction and transferring the X=V-Functional entity precursor to the recipient. The chemical structure formed has, in the event the nucleophilic group is an amine attached to a scaffold, the general formula:

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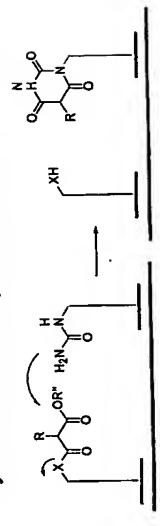
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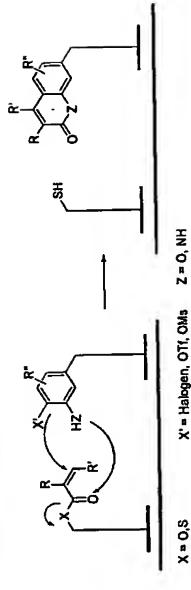
The encoding element may comprise one, two, three or more codons, i.e. sequences that may be specifically recognised by a complementing element. Each of

In which

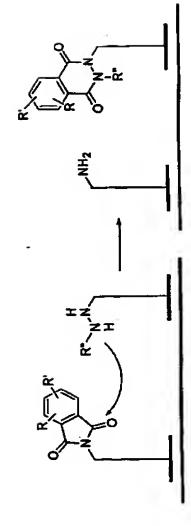
Scaffold-NH-X(V)-Functional entity precursor

F. Pyrimidine formation by reaction of ureas with Malonates

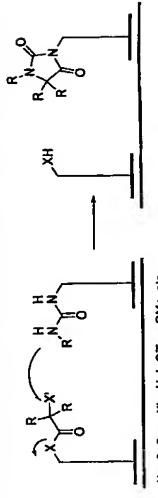
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G. Coumarine or quinolinolin formation by a Heck reaction followed by a nucleophilic substitution

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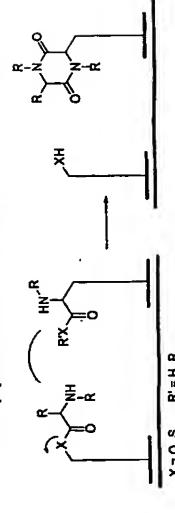
H. Phthalhydrazide formation by reaction of Hydrazines and Phthalimides

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J. Hydantoin formation by reaction of Urea and α -substituted Esters

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According to a preferred aspect of the invention the building blocks are used for the formation of a library of compounds. The complementing element of the building block is used to identify the functional entity. Due to the enhanced proximity between reactive groups when the complementing entity and the encoding element are contacted, the functional entity together with the identity programmed in the complementing element is transferred to the encoding element associated with recipient reactive group. Thus, it is preferred that the sequence of the complementing element is unique in the sense that the same sequence is not used for another functional entity. The unique identification of the functional entity enable the possibility of decoding the encoding element in order to determine the synthetic history of the molecule formed. In the event two or more functional entities have been transferred to a scaffold, not only the identity of the transferred functional entities can be determined. Also the sequence of reaction and the type of reaction involved can be determined by decoding the encoding element. Thus, according to a preferred embodiment of the invention, each different member of a library comprises a complementing element having a unique sequence of nucleotides, which identifies the functional entity.

Brief description of the drawings**I. Diketopiperazine formation by reaction of Amino Acid Esters**

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Fig. 1 shows to setups for functional entity transfer.

Fig. 2 shows examples of specific base pairing.

Fig. 3 shows examples of non-specific base-pairing

Fig. 4 shows examples of backbones.

Fig. 5 shows a gel with the results of the experiments reported in example 22.

Fig. 6 shows three examples of building block according to the present invention.

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Detailed Description of the Invention

A building block of the present invention is characterized by its ability to transfer its functional entity to a receiving chemical entity. This is done by forming a new covalent bond between the receiving chemical entity and cleaving the bond between the carrier moiety and the functional entity of the building block.

Two setups for generalized functional entity transfer from a building block are depicted in figure 1. In the first example, one complementing element of a building block recognizes a template carrying another functional entity, hence bringing the functional entities in close proximity. This results in a reaction between functional entity precursor 1 and 2 forming a covalent bond between these concurrent with the cleavage of the bond between functional entity precursor 2 and its linker. In the second example, a template brings together two building blocks resulting in functional entity transfer from one building block to the other.

Fig. 6 discloses three examples of building blocks. For illustrative purposes the individual features used in the claims are indicated. In the upper compound the spacer part of the linker connects to a 3'-phosphate group of an oligonucleotide. The first part of the linker, i.e. the spacer, is an aliphatic chain ending in a nitrogen atom. The nitrogen atom bridges to the S-C-connecting group, which is an N-acylated arylmethylamine. The carrier attached to the left hand side carbonyl group of the S-C-connecting group is a nitrophenyl group. In the para position of the nitrophenyl group, the C-F-connecting group is attached. When the building block is presented to a nucleophilic group, the functional entity precursor and the carbonyl group of the C-F-connecting group is transferred. In the event the nucleophilic group is an amine, the bond formed is an amide bond.

The middle compound of Fig. 6 discloses a linker attached to the 5' position of an oligonucleotide. The linker is attached through a 5' phosphate group and extends into a short 3 member aliphatic chain to another phosphate group which is connected to a linker terminal nitrogen group via a PEG part. The linker nitrogen group is connected to the carrier via a carbonyl group. The carrier is of the thiophenyl type as the sulphur of the C-F-connecting group connects to the ring structure. When the building block is presented to a nucleophilic group, such as an amine, the functional entity precursor together with the carbonyl group of the C-F-connecting group is

transferred to said recipient group forming an amide bond when the nucleophile is an amine.

The lower compound shown on Fig. 6 illustrates an example of the linker being connected to the nucleobase of the oligonucleotide complementing element. More specifically, the linker connects to the 5 position of a pyrimidine. The linker extends through an α - β unsaturated N-methylated amide to the S-C-connecting group, which is a 4-amino methyl benzoic acid derivative. The carrier is of the phenol type and the functional entity precursor together with the thiocarbonyl group of the C-F-connecting group may be transferred to a recipient reactive group forming an amide in the event the recipient reactive group is an amine.

In a library synthesis, several building blocks are mixed in a reaction vessel and the added templates ensure that the building blocks - consequently the functional entities - are combined in the desired manner. As several building blocks are employed at the same time, the use of *in situ* generated building blocks is disfavoured for practical reasons.

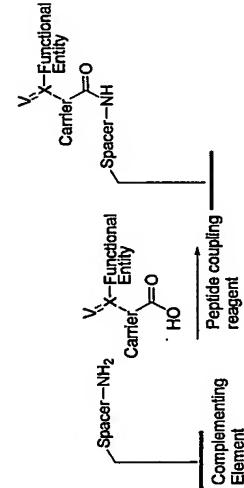
Building blocks for library synthesis should possess the necessary reactivity to enable the transfer of the functional entity but should also be stable enough to endure storage and the conditions applied during library synthesis. Hence fine tuning of the reactivity for a particular building block is vital. The reactivity of a building block depends partly on the characteristics of the functional entity and the characteristics of the carrier. E.g. a highly reactive functional entity attached to a highly reactive carrier would form a building block that may be susceptible to hydrolysis during the library synthesis thus preventing successful transfer of one functional entity to another. Further, if transfer of a functional entity precursor is faster than coding element - complementing element recognition unspecific reactions may result.

Therefore, the present invention particularly relates to practically useful library building blocks capable of acting as acylating agents, thioacetylating agents or amidinating agents with a balanced reactivity. Such building blocks may be assembled by several different pathways as described below.

Formation of an amide bond between a carboxylic acid of the Carrier and an amino group of a Spacer

The Carrier-Functional Entity Preclinical ensemble may be bound to the Spacer by

several different reactions as illustrated below

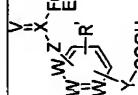


$X = -C, -S, -P$, or $-S(O)$, or $-P(O)$.
 $\forall S = O, S_a$, or NB, wherein $B = H$ or C_a , all $[X]$

$X = -C_1 - S_1 - P_1 - S(O)_1$, or $-P(O)_1$.
 $V = O, S$, or N , wherein $R = H$ or $C_1 - C_6$ -alkyl

$X = -C-, -S-, -P-, -S(O)-$, or $-P(O)-$.
 $V = O, S$, or NB , where in $B = H$ or $C-C_6H_5alkyl$

Examples of Creative Functional Entities: Presentations



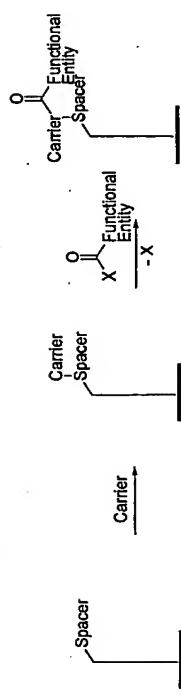
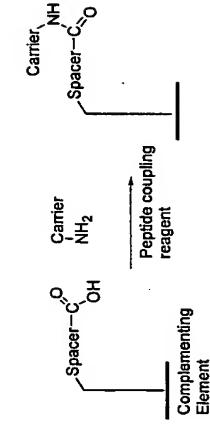
R' = -H, -Halogen, -NO₂, -CN, -C(Halogen)₃, -C(O)R', -C(O)NHR", -C(O)NR'₂, -NC(O)R', -S(O)₂NHR", -S(O)₂NR'₂, -S(O)₂R", -P(O)R", -P(O)R'R", -S(O)-OR", -S(O)-OR', -NR'R", -P(O)-R", H, C_r-C_s alkyl, C_r-C_s alkenyl, C_r-C_s alkynyl or aryl, chosen independently

Y = absent, C_r-C_s Alkylene, C_r-C_s Alkenylene, C_r-C_s Alkynylene, Heteroarylene, Carbonyl, C₆ Alkynylene, Arylene, Heteroarylene, Carbonyl, SO₂CH₂Br

<p>Functional Entity</p>	$Z = O, S$ $X = -C_r -S_r -P_r -S(O)_r -P(O)_r$ $V = O, S, NR, R = H, C_1-C_6 \text{ alkyl}$ $Y = \text{absent}, C_1-C_6 \text{ Alkyl}, C_1-C_6 \text{ Alkenyl}, C_1-C_6 \text{ Aryl}, \text{Heteroaryl}, \text{Carbonyl}, -SO_2CH_2-$
<p>Functional Entity</p>	$Z = S$ $R' = -CH_2-$ $X = -C_r -S_r -P_r -S(O)_r -P(O)_r$ $V = O, S, NR, R = H, C_1-C_6 \text{ alkyl}$ $Y = \text{nothing}, C_1-C_6 \text{ Alkylene}, C_1-C_6 \text{ Alkenylene}, C_1-C_6 \text{ Arylene}, \text{Heteroarylene}, \text{Carbonyl}, -SO_2CH_2-$
<p>Functional Entity</p>	$W = CH \text{ or } N$ $X = -C_r -S_r -P_r -S(O)_r -P(O)_r$ $V = O, S, NR, R = H, C_1-C_6 \text{ alkyl}$ $R' = -H, \text{-Halogen}, -NO_2, -CN, -C(Halogen)_3, -C(O)R^*, -C(O)NHR^*, C(O)NR^*, -NC(O)R^*, -S(O)_2NHR^*, -S(O)_2NR^*, -S(O)_2R^*, -P(O)_2R^*, -S(O)R^*, P(O)R^*, -S(O)-OR^*, -S(O)-OR^*, -N'R^*_3,$ $R'' = \text{alkyl, alkenyl, alkyne, aryl.}$ $Y = \text{nothing}, C_1-C_6 \text{ Alkyl}, C_1-C_6 \text{ Alkenyl}, C_1-C_6 \text{ Aryl}, \text{Heteroaryl}, \text{Carbonyl}, -SO_2CH_2-$
<p>Functional Entity</p>	$W = CH \text{ or } N$ $X = -C_r -S_r -P_r -S(O)_r -P(O)_r$ $V = O, S, NR, R = H, C_1-C_6 \text{ alkyl}$ $R' = -H, \text{-Halogen}, -NO_2, -CN, -C(Halogen)_3, -C(O)R^*, -C(O)NHR^*, C(O)NR^*, -NC(O)R^*, -S(O)_2NHR^*, -S(O)_2NR^*, -S(O)_2R^*, -P(O)_2R^*, -P(O)R^*, -S(O)-R^*, P(O)-OR^*, -S(O)-OR^*, -N'R^*_3,$ $R'' = H, C_1-C_6 \text{ alkyl}, C_1-C_6 \text{ alkenyl}, C_1-C_6 \text{ alkyne}, C_1-C_6 \text{ alkynyl or aryl, chosen independently}$ $Y = \text{absent}, C_1-C_6 \text{ Alkyl}, C_1-C_6 \text{ Alkenyl}, C_1-C_6 \text{ Aryl}, \text{Heteroarylene}, \text{Carbonyl}, -SO_2CH_2-$

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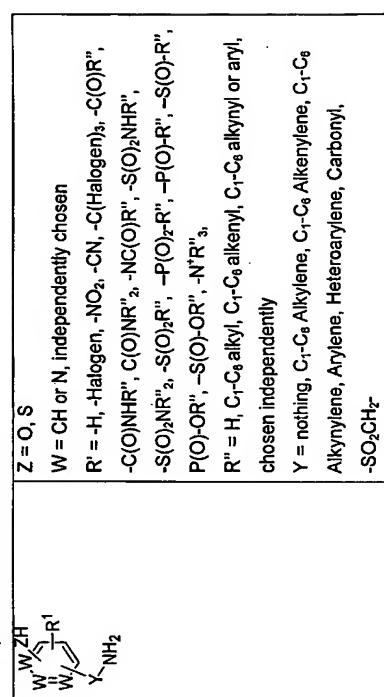
<p>Functional Entity</p> <p>$X = -C, -S, -P, -S(O), -P(O)$ $V = O, S, NR, R = H, C_1-C_6 \text{ alkyl}$ $R' = -H, -\text{Halogen}, -NO_2, -CN, -C(\text{Halogen})_3, -C(O)R'', -C(O)NR'', C(O)NR''_2, -NC(O)R'', -S(O)NR'', -S(O)NR''_2, -S(O)OR'', -P(O)R'', -P(O)OR'', -S(O)R'', -N'R''_3,$ $P(O)R'', -S(O)R'', P(O)OR'', -S(O)OR'', -N'R''_3,$ $R'' = H, C_1-C_6 \text{ alkyl, } C_1-C_6 \text{ alkenyl, } C_1-C_6 \text{ alkynyl or aryl, chosen independently}$ $Y = \text{nothing, } C_1-C_6 \text{ Alkylene, } C_1-C_6 \text{ Alkenylene, } C_1-C_6 \text{ Alkynylene, } \text{Arylene, Heteroarylene, Carbonyl, } -SO_2CH_2$</p>	<p>Functional Entity</p> <p>$W = O, S$ $X = -C, -S, -P, -S(O), -P(O)$ $V = O, S, NR, R = H, C_1-C_6 \text{ alkyl}$ $W = CH \text{ or } N, \text{ chosen independently}$ $R' = -H, -\text{Halogen}, -NO_2, -CN, -C(\text{Halogen})_3, -C(O)R'', -C(O)NR'', C(O)NR''_2, -NC(O)R'', -S(O)NR'', -S(O)NR''_2, -S(O)OR'', -P(O)R'', -P(O)OR'', -S(O)R'', -N'R''_3,$ $P(O)R'', -S(O)R'', P(O)OR'', -S(O)OR'', -N'R''_3$ $\text{chosen independently}$ $p = 0, 1, 2, 3 \text{ or } 4$ $Y = \text{absent, } C_1-C_6 \text{ Alkylene, } C_1-C_6 \text{ Alkenylene, } C_1-C_6 \text{ Alkynylene, } \text{Arylene, Heteroarylene, Carbonyl, } -SO_2CH_2$</p>	<p>Functional Entity</p> <p>$Z = O, S$ $X = -C, -S, -P, -S(O), -P(O)$ $V = O, S, NR, R = H, C_1-C_6 \text{ alkyl}$ $W = CH \text{ or } N, \text{ chosen independently}$ $R' = -H, -\text{Halogen}, -NO_2, -CN, -C(\text{Halogen})_3, -C(O)R'', -C(O)NR'', C(O)NR''_2, -NC(O)R'', -S(O)NR'', -S(O)NR''_2, -S(O)OR'', -P(O)R'', -P(O)OR'', -S(O)R'', -N'R''_3,$ $P(O)R'', -S(O)R'', P(O)OR'', -S(O)OR'', -N'R''_3$ $\text{chosen independently}$ $p = 0, 1, 2, 3 \text{ or } 4$ $Y = \text{nothing, } C_1-C_6 \text{ Alkylene, } C_1-C_6 \text{ Alkenylene, } C_1-C_6 \text{ Alkynylene, } \text{Arylene, Heteroarylene, Carbonyl, } -SO_2CH_2$</p>
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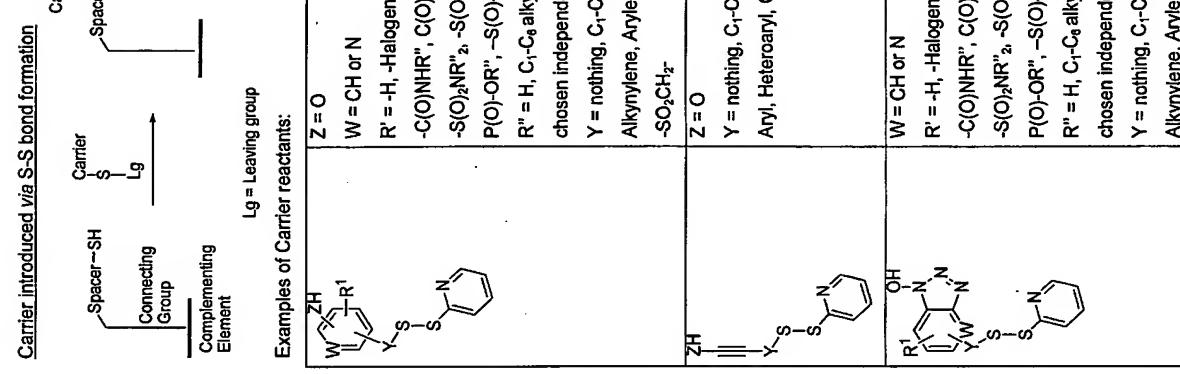
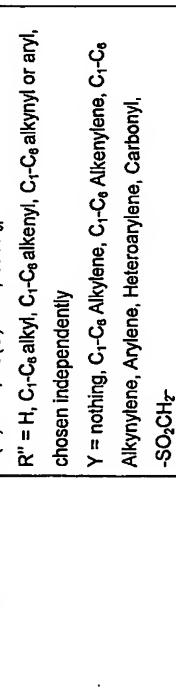
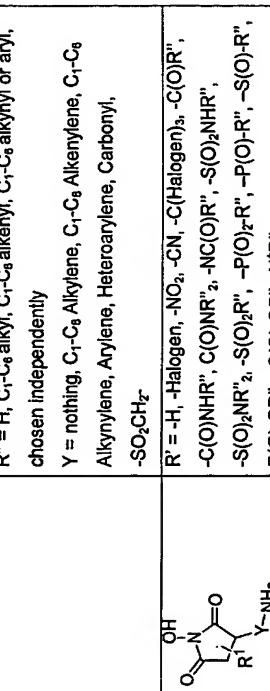
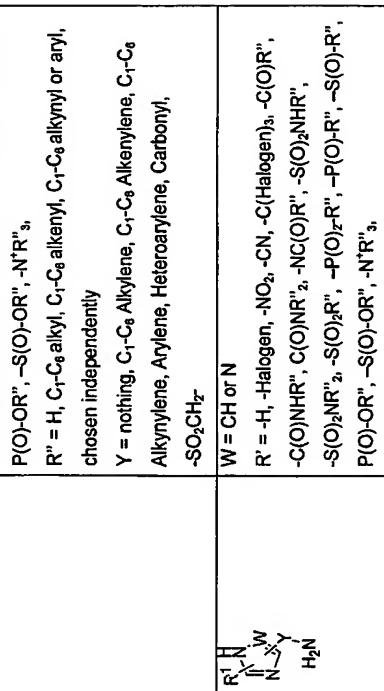
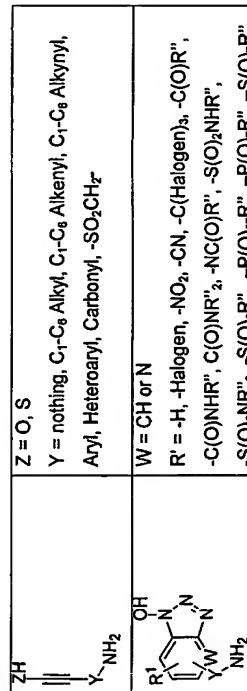
Stepwise loading of the carrier and the functional entity $X = \text{leaving group}$ **Sequential loading of the carrier and the functional entity allows other types of chemistries to be used.****Carrier introduced via amide bond formation**

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chemistries to be used.

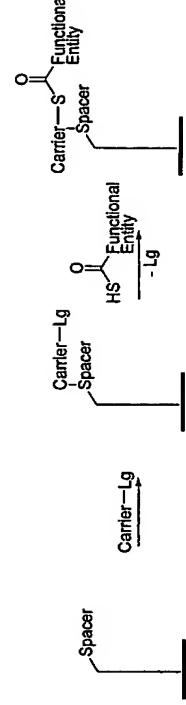
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Examples of Carrier reactants:

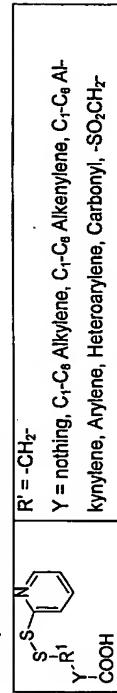


	-SO ₂ CH ₂ -
	R = CH or N R' = -H, -Halogen, -NO ₂ , -CN, -C(Halogen) ₃ , -C(O)R'', -C(O)NHR'', C(O)NR'', -NC(O)R'', -S(O)NHR'', -S(O)NR'', -S(O)R'', -S(O)R ₂ R'', -P(O)R ₂ R'', -P(O)R-R'', -S(O)R-R'', -P(O)OR'', -S(O)OR'', -N'R'', R'' = H, C ₁ -C ₆ alkyl, C ₁ -C ₆ alkenyl, C ₁ -C ₆ alkynyl or ary, chosen independently Y = nothing, C ₁ -C ₆ Alkylene, C ₁ -C ₆ Alkenylene, C ₁ -C ₆ Alkynylene, Arylene, Heteroarylene, Carbonyl, -SO ₂ CH ₂
	R = -H, -Halogen, -NO ₂ , -CN, -C(Halogen) ₃ , -C(O)R'', -C(O)NHR'', C(O)NR'', -NC(O)R'', -S(O)NHR'', -S(O)NR'', -S(O)R'', -S(O)R ₂ R'', -P(O)R ₂ R'', -P(O)R-R'', -S(O)R-R'', -P(O)OR'', -S(O)OR'', -N'R'', R'' = H, C ₁ -C ₆ alkyl, C ₁ -C ₆ alkenyl, C ₁ -C ₆ alkynyl or ary, chosen independently Y = nothing, C ₁ -C ₆ Alkylene, C ₁ -C ₆ Alkenylene, C ₁ -C ₆ Alkynylene, Arylene, Heteroarylene, Carbonyl, -SO ₂ CH ₂

Functional Entity introduced as a thioacid



Examples of Carrier reactants:



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As discussed above the C-F-connecting group may be selected from a large group of compounds of the general formula -Z-(X=Y)- or -(X=Y)-. In certain aspects of the invention X = C, S, P, S(=O), or P(=O), in another preferred embodiment X = C, S, or S(=O), and in still another preferred embodiment X = C. In certain aspects of the invention V = O, S, NR¹⁰ or NOR¹⁰, in another preferred embodiment V = O or NR¹⁰, and in still another preferred embodiment V = O. In a certain aspect of the invention Z = O, or S, in another preferred embodiment, Z = O, and in still another preferred embodiment, Z = S.

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Wherein R¹⁰ is H, alkyl, alkenyl, alkadienyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of SmR¹¹R¹², R¹³, Sm(OR¹¹)R¹²R¹³, Sm(OR¹¹)OR¹²R¹³, BR¹¹R¹², B(OR¹¹)R¹², B(OR¹¹)(OR¹²), halogen, CN, CNO, C(halogen)₃, OR¹¹, OC(=O)R¹¹, B(OR¹¹)OR¹², SR¹¹, S(=O)R¹¹, S(=O)R¹², S(=O₂)R¹¹, S(=O₂)R¹², NR¹¹R¹², NO₂, N₃, NR¹¹R¹²R¹³, NR¹¹OR¹², NR¹¹NR¹²R¹³, NR¹¹C(=O)R¹², NR¹¹C(=O)NR¹²R¹³, NC, P(=O)(OR¹¹)OR¹², P⁺R¹¹FR¹², C(=O)R¹¹, C(=O)R¹², C(=O)NR¹¹NR¹², C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹NR¹²R¹³, C(=NR¹¹)NR¹²R¹³, C(=NR¹¹)NR¹²R¹³ or R¹⁴, wherein,

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R^{11} , R^{12} and R^{13} independently is H, alkyl, alkenyl, alkynyl, alkadienyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of halogen, CN, CNO, C(halogen)₃, OR¹⁴, OC(=O)R¹⁴, OC(=O)NR¹⁴R¹⁵, SR¹⁴, S(=O)R¹⁴, S(=O)₂R¹⁴, Si(=O)NR¹⁴R¹⁵, NO₂, N₃, NR¹⁴R¹⁵, NR¹⁴R¹⁵R¹⁶, NR¹⁴NR¹⁵R¹³, NR¹⁴C(=O)R¹⁵, NR¹⁴C(=O)OR¹⁵, NR¹⁴C(=O)NR¹⁵, NC, P(=O)(OR¹⁴)OR¹⁵, P(=O)(OR¹⁴)C(=O)R¹⁵, C(=O)R¹⁴, C(=O)NR¹⁴, C(=O)NR¹⁴R¹⁵, C(=NOR¹⁴)R¹⁵, C(=NNR¹⁴)R¹⁵, C(=O)OR¹⁴, C(=O)NR¹⁴R¹⁵, C(=O)NR¹⁴OR¹⁵ C(=NR¹⁴)NR¹²R¹³, C(=NR¹⁴)NR¹²R¹³ or R¹⁴, C(=O)NR¹⁴NR¹⁵R¹⁶, wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring, wherein,

R^{14} , R^{15} and R^{16} independently is H, alkyl, alkenyl, alkynyl, alkadienyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl and wherein R¹⁴ and R¹⁵ may together form a 3-8 membered heterocyclic ring or R¹⁴ and R¹⁶ may together form a 3-8 membered heterocyclic ring or R¹⁵ and R¹⁶ may together form a 3-8 membered heterocyclic ring, in a further preferred embodiment,

R^{10} is H, C₁-C₆ alkyl, C₂-C₆ alkenyl, C₄-C₆ alkadienyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of Si(OR¹¹)R¹², R¹³, Si(OR¹¹)R¹²R¹³, Sn(OR¹¹)R¹²R¹³, Sn(OR¹¹)OR¹²R¹³, Bi(OR¹¹)R¹², Bi(OR¹¹)OR¹², halogen, CN, CNO, C(halogen)₃, OR¹¹, OC(=O)R¹¹, OC(=O)OR¹¹, OC(=O)NR¹¹R¹², SR¹¹, Si(=O)R¹¹, Si(=O)NR¹¹R¹², NO₂, N₃, NR¹¹R¹², NR¹¹OR¹², NR¹¹NR¹²R¹³, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, NC, P(=O)(OR¹¹)OR¹², P(=O)(OR¹¹)C(=O)R¹², C(=O)R¹¹, C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹² or R¹⁴, C(=O)NR¹¹NR¹²R¹³ or R¹⁴, wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, C₄-C₈ alkadienyl, C₃-C₇ cycloalkyl, aryl or heteroaryl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring, wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, C₄-C₈ alkadienyl, C₃-C₇ cycloalkyl, aryl or heteroaryl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring, wherein,

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In another preferred embodiment,
 R^{10} is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of halogen, CN, C(halogen)₃, OR¹¹, OC(=O)R¹¹, OC(=O)NR¹¹R¹², SR¹¹, Si(=O)R¹¹, Si(=O)NR¹¹R¹², NO₂, NR¹¹OR¹², NR¹¹NR¹²R¹³, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, P(=O)(OR¹¹)OR¹², C(=O)OR¹¹R¹², C(=NOR¹¹)R¹², C(=O)NR¹¹R¹², C(=O)NR¹¹NR¹²R¹³, C(=O)NR¹¹NR¹²R¹³ or R¹⁴, wherein,
 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, aryl or heteroaryl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring, wherein,
 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, aryl or heteroaryl, C₃-C₇ cycloalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, OC(=O)R¹¹, OC(=O)NR¹¹R¹², SR¹¹, Si(=O)R¹¹, Si(=O)NR¹¹R¹², NO₂, NR¹¹OR¹², NR¹¹NR¹²R¹³, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, P(=O)(OR¹¹)OR¹², C(=O)OR¹¹R¹², C(=NOR¹¹)R¹², C(=O)NR¹¹NR¹²R¹³, C(=O)NR¹¹NR¹²R¹³ or R¹⁴, wherein,
 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, aryl or heteroaryl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring, wherein,
 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, aryl or heteroaryl, C₃-C₇ cycloalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, Si(=O)R¹¹, Si(=O)NR¹¹R¹², NO₂, NR¹¹OR¹², NR¹¹NR¹²R¹³, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, P(=O)(OR¹¹)OR¹², C(=O)OR¹¹R¹², C(=NOR¹¹)R¹², C(=O)NR¹¹NR¹²R¹³, C(=O)NR¹¹NR¹²R¹³ or R¹⁴, wherein,

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R^{11} , R^{12} , R^{13} and R^{14} independently is H, C_1 - C_6 alkyl, C_3 - C_7 cycloalkyl, C_3 - C_7 cyclo-heteroalkyl, aryl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring or R^{12} and R^{13} may together form a 3-8 membered heterocyclic ring,

5 R^{10} is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, aziridinyl, azetidinyl, pyrrolidinyl, piperidinyl, morpholinyl, phenyl, naphthyl, thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

10 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C_1 - C_6 alkyl, C_3 - C_7 cyclo-heteroalkyl, aryl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring or R^{12} and R^{13} may together form a 3-8 membered heterocyclic ring,

15 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C_1 - C_6 alkyl, C_3 - C_7 cyclo-heteroalkyl, aryl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{12} and R^{13} may together form a 3-8 membered heterocyclic ring,

20 R^{10} is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)OR¹¹, C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

25 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C_1 - C_6 alkyl, C_3 - C_7 cyclo-heteroalkyl, aryl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring or R^{12} and R^{13} may together form a 3-8 membered heterocyclic ring,

30 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C_1 - C_6 alkyl, C_3 - C_7 cyclo-heteroalkyl, aryl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

31

NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)OR¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹R¹², C(=O)OR¹¹,

wherein,

5 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C_1 - C_6 alkyl, C_3 - C_7 cyclo-heteroalkyl, aryl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring or R^{12} and R^{13} may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

10 R^{10} is H, phenyl, thiienyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)OR¹¹R¹² or R¹⁴,

wherein,

15 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C_1 - C_6 alkyl, C_3 - C_7 cyclo-heteroalkyl, aryl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring or R^{12} and R^{13} may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

20 R^{10} is H, phenyl or napthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)OR¹¹, C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

25 R^{11} , R^{12} , R^{13} and R^{14} independently is H, C_1 - C_6 alkyl, C_3 - C_7 cyclo-heteroalkyl, aryl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring or R^{12} and R^{13} may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

30 R^{10} is H, thiienyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)₂NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹²,

wherein,

32

$\text{NR}^{11}\text{C}(=\text{O})\text{OR}^{12}$, $\text{NR}^{11}\text{C}(=\text{O})\text{NR}^{12}\text{R}^{13}$, $\text{C}(=\text{O})\text{R}^{11}$, $\text{C}(=\text{NOR}^{11})\text{R}^{12}$, $\text{C}(=\text{O})\text{OR}^{14}$,
 $\text{C}(=\text{O})\text{NR}^{11}\text{R}^{12}$, $\text{C}(=\text{O})\text{NR}^{11}\text{OR}^{12}$ or R^{14} ,

wherein,

5 R^{11} , R^{12} , R^{13} and R^{14} independently is H, $\text{C}_1\text{-C}_8$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, anyl or heteroaryl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring or R^{12} and R^{13} may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

10 R^{10} is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, phenyl, naphthyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

wherein,

15 R^{11} , R^{12} , R^{13} and R^{14} independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

20 R^{10} is H, azidinyl, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, Si(=O)R¹¹, Si(=O)NR¹¹R¹², NR¹¹C(=O)R¹², NR¹¹C(=O)NR¹¹R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

25 R^{11} , R^{12} , R^{13} and R^{14} independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

30 R^{10} is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered

in still another preferred embodiment,

33

R^{10} is H, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, Si(=O)R¹¹, Si(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹²,

5 C(=O)OR¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², C(=O)OR¹⁴, wherein,
 R^{11} , R^{12} , R^{13} and R^{14} independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

10 R^{10} is H, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

15 R^{10} is H, phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, Si(=O)R¹¹, Si(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)NR¹²R¹³, S(=O)R¹², NO₂, NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², wherein,

20 R^{11} , R^{12} , R^{13} and R^{14} independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

25 R^{10} is H, phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, Si(=O)R¹¹, Si(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)NR¹²R¹³, S(=O)R¹², NO₂, NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², wherein,

30 R^{11} , R^{12} , R^{13} and R^{14} independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

35 R^{11} , R^{12} , R^{13} and R^{14} independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, thiényl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{11} and R^{12} may together form a 3-8 membered heterocyclic ring or R^{11} and R^{13} may together form a 3-8 membered heterocyclic ring,

34

heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring.

in still another preferred embodiment,

R¹⁰ is H, methyl, ethyl, propyl, butyl, cyclopentydyl, cyclohexyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)C(=O)R¹¹, NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)OR¹¹)R¹², C(=O)OR¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹² or R¹⁴, wherein,

R¹¹, R¹², R¹³ and R¹⁴ independently is H, methyl, ethyl, propyl or butyl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R¹⁰ is H, azidinyl, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)₃NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹² or R¹⁴, wherein,

R¹¹, R¹², R¹³ and R¹⁴ independently is H, methyl, ethyl, propyl or butyl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring,

in still another preferred embodiment,

R¹⁰ is H, phenyl, naphyl, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)₃NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹² or R¹⁴, wherein,

WO 03/078626

35

R¹¹, R¹², R¹³ and R¹⁴ independently is H, methyl, ethyl, propyl or butyl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring,

5

in still another preferred embodiment,

R¹⁰ is H, phenyl or naphyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)₃NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

R¹¹, R¹², R¹³ and R¹⁴ independently is H, methyl, ethyl, propyl or butyl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring,

10

in still another preferred embodiment,

R¹⁰ is H, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)₃NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

R¹¹, R¹², R¹³ and R¹⁴ independently is H, methyl, ethyl, propyl or butyl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring,

15

in still another preferred embodiment,

R¹⁰ is H, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)₃NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

R¹¹, R¹², R¹³ and R¹⁴ independently is H, methyl, ethyl, propyl or butyl and wherein R¹¹ and R¹² may together form a 3-8 membered heterocyclic ring or R¹¹ and R¹³ may together form a 3-8 membered heterocyclic ring or R¹² and R¹³ may together form a 3-8 membered heterocyclic ring,

20

in still another preferred embodiment,

R¹⁰ is H, phenyl, naphyl, thienvyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)₃NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹², C(=O)NR¹¹OR¹² or R¹⁴,

36

R^{11} , R^{12} , R^{13} and R^{14} independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another preferred embodiment,

R^{10} is aziridinyl, azaetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=N)R¹¹R¹², C(=O)OR¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another preferred embodiment,

R^{10} is phenyl, naphthyl, thiényl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=N)R¹¹R¹², C(=O)OR¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another preferred embodiment,

R^{10} is phenyl, naphthyl, thiényl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=N)R¹¹R¹², C(=O)OR¹¹, C(=O)NR¹¹R¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another preferred embodiment,

R^{10} is thiényl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹²,

wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

37

S(=O)R¹¹, S(=O)₂R¹¹, S(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=N)R¹¹R¹², C(=O)OR¹¹, C(=O)NR¹¹OR¹², C(=O)OR¹¹,

wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another preferred embodiment,

R^{10} is methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)NR¹¹R¹², NO₂, NR¹¹R¹², NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=N)R¹¹R¹², C(=O)NR¹¹OR¹² or R¹⁴,

wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, phenyl, naphthyl, furyl, pyridyl, quinolinyl or isoquinolinyl,

In still another preferred embodiment,

R^{10} is methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=N)R¹¹R¹², C(=O)OR¹¹, C(=O)NR¹¹OR¹², C(=O)OR¹¹,

wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, phenyl, naphthyl, thiényl, furyl, pyridyl, quinolinyl or isoquinolinyl,

In still another preferred embodiment,

R^{10} is phenyl, thiényl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, S(=O)NR¹¹R¹², NO₂, NR¹¹C(=O)R¹², NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=N)R¹¹R¹², C(=O)OR¹¹, C(=O)NR¹¹OR¹², C(=O)OR¹¹,

wherein,

R^{11} , R^{12} , R^{13} and R^{14} independently is H, phenyl, naphthyl, thiényl, furyl, pyridyl, quinolinyl or isoquinolinyl,

88

R^{11} , R^{12} , R^{13} and R^{14} independently is H, phenyl, naphthyl, furyl, thiényl, pyridyl, quinolinyl or isoquinolinyl.

In still another preferred embodiment

R^0 is phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹, S(=O)R¹¹, S(=O)₂R¹¹, NR¹¹R¹², NO₂, NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, S(=O)NR¹¹R¹², C(=O)NR¹¹R¹², C(=O)NR¹¹C(=O)OR¹², C(=O)NR¹¹C(=O)NR¹² or R¹⁴.

wherein, R^1 , R^2 , R^3 and R^4 independently is H, phenyl, naphthyl, thienv, furyl, pyridinyl, acetylonyl or isocoumaronyl.

In still another preferred embodiment,
R¹⁰ is thieryl, furyl, pyridyl, quinolyl or isoquinoliny1 optionally substituted with one
or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹¹,
S(O)R¹¹, S(O₂)R¹¹, S(O)NR¹¹R¹², NO₂, NR¹¹R¹², NR¹¹C(=O)R¹²,
NR¹¹C(=O)OR¹², NR¹¹C(=O)NR¹²R¹³, C(=O)R¹¹, C(=NOR¹¹)R¹², C(=O)OR¹¹,
C(=O)MP¹¹R¹², C(=O)MP¹¹OR¹² or R¹⁴

wherein,
 R^{11}, R^{12}, R^{13} and R^{14} independently is H, phenyl, naphthyl, thiophenyl, furyl, pyridinyl,

in still another nonferrous combination

R^{10} is H, C₁-C₈ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl, aryl or heteroaryl

in still another preferred embodiment,

R^{ic} is H ,

in still another preferred embodiment, B^{10} is $\text{C}_6\text{-C}_7$ -alkyl $\text{C}_6\text{-C}_7$ -cycloalkyl or $\text{C}_6\text{-C}_7$ -cyclo(hetero)alkyl

in still another preferred embodiment,
 R^{10} is methyl, ethyl, propyl or butyl

in still another deferred embodiment

6

B^{10} in cyclohexyl cyclopentyl cyclohexyl or cyclohexyl

in still another preferred embodiment

In still another preferred embodiment,
B¹⁰ is an or heteroaryl

in still another preferred embodiment, R¹⁰ is phenyl or naphthyl.

R¹⁰ is thiényl, furyl, pyridyl, quinolinyl or isoquinolinyl.

The Functional entity precursor may be selected from any transferable chemical group capable of forming a connection to the C-F-connecting group. In certain aspects of the invention the functional entity precursor is represented by the formula

wherein Z is absent, O, S or NR²⁴. In certain embodiment Z is absent. In another embodiment Z is O. In still another embodiment Z is S, and in still a further embodiment Z is NR²⁴.

R^{17} and R^{24} independently is H, alkyl, alkenyl, alkynyl, alkadienyl, cycloalkyl, cyclo-
heteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents
selected from the group consisting of $\text{Sn}(OR^{18})_2R^{20}$, $\text{Sn}(OR^{18})R^{19}R^{20}$,
 $\text{Sn}(OR^{18})(OR^{19})R^{20}$, $\text{BR}^{18}R^{19}$, $\text{B}(OR^{18})R^{19}$, $\text{B}(OR^{18})(OR^{19})$,
 $\text{C}(\text{halogen})_3$, OR^{18} , $\text{OC}(=\text{O})R^{18}$, $\text{OC}(=\text{O})OR^{18}$, $\text{OC}(=\text{O})\text{NR}^{18}$,
 $\text{S}(=\text{O})_2R^{18}$, $\text{S}(=\text{O})\text{NR}^{18}R^{19}$, NO_2 , N_3 , $\text{NR}^{18}R^{19}R^{20}$, $\text{NR}^{18}\text{OR}^{18}$,
 $\text{NR}^{18}\text{C}(=\text{O})R^{18}$, $\text{NR}^{18}\text{C}(=\text{O})\text{OR}^{18}$, $\text{NR}^{18}\text{C}(=\text{O})\text{NR}^{18}R^{19}$,
 $\text{P}^+R^{18}R^{19}R^{20}$, $\text{C}(=\text{O})R^{18}$, $\text{C}(=\text{NR}^{18})R^{19}$, $\text{C}(=\text{NOR}^{18})R^{19}$,
 $\text{C}(=\text{NNR}^{18}R^{19})R^{19}$, $\text{C}(=\text{O})\text{NR}^{18}OR^{18}$, $\text{C}(=\text{O})\text{NR}^{18}\text{NR}^{19}R^{20}$, $\text{C}(=\text{NR}^{18})\text{NR}^{19}R^{20}$,
 $\text{C}(=\text{O})\text{NR}^{18}\text{NR}^{19}R^{20}$ or R^{21} ,
wherein

SUBSTITUTE SHEET (BIII E 26)

40

R^{18} , R^{19} and R^{20} independently is H, alkyl, alkenyl, alkynyl, alkadienyl, cycloalkyl, cycloheteroalkyl, aryl or heteraryl, optionally substituted with one or more substituents selected from the group consisting of halogen, CN, CNO, C(halogen)₃, OR²¹, OC(=O)OR²¹, OC(=O)NR²¹, OC(=O)NR²¹R²², SR²¹, Si(=O)R²¹, Si(=O)F, R²¹, Si=O₂NR²¹R²², NO₂, N₃, NR²¹R²², NR²¹NR²², NR¹⁸NR²⁰, NR²¹Ci(=O)R²², NR²¹Ci(=O)OR²², NR²¹Ci(=O)NR²²R²³, NC, Pi(=O)(OR²¹)OR²², P²¹R¹⁸R²⁰, Ci(=O)R²¹, Ci(=O)NR²¹R²², Ci(=NOR²¹)R²², C(=NNR¹⁸)R²², C(=NNR¹⁹)R²⁰, C(=O)NR²¹R²², Cl(=O)NR²¹OR²², C(=NR¹⁸)NR¹⁹R²⁰ or C(=O)NR²¹NR²²R²³, wherein R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring. R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring.

Wherein

R^1 , R^2 , and R^{22} independently is H, alkyl, alkenyl, alkynyl, alkadienyl, cycloalkyl, cycloalkenoxy, cycloalkynyl, aryl or heteroaryl and wherein R^{21} and R^{22} may together form a 3-8 membered heterocyclic ring or R^{21} and R^{22} may together form a 3-8 membered heterocyclic ring or R^{22} and R^{23} may together form a 3-8 membered heterocyclic ring.

In a further embodiment, R¹⁷ and R²⁴ independently is H, C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, C₃-C₈ cycloalkyl, C₃-C₇ cyclohexoalkyl, C₃-C₇ cycloheptoalkyl, ary or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of SnR¹⁸R¹⁹R²⁰, Sn(OR¹⁸)R¹⁹R²⁰, Sn(OR¹⁸)²R¹⁹, BR¹⁹R¹⁸, B(OR¹⁸)R¹⁹, halogen, CN, CNO, C(halogen)₃, OR¹⁸, OC(=O)R¹⁸, OC(=O)OR¹⁸, OC(=O)NR¹⁸, SR¹⁸, S(=O)R¹⁸, S(=O)NR¹⁸, S(=O)₂NR¹⁸R¹⁹, NO₂, N₃, NR¹⁹R¹⁸, OC(=O)NR¹⁸R¹⁹, NR¹⁹OR¹⁸, NR¹⁹NR¹⁸R¹⁹, NR¹⁹NR¹⁸OR¹⁹, NR¹⁹C(=O)R¹⁸, NR¹⁹C(=O)OR¹⁸, NR¹⁹C(=O)NR¹⁸R¹⁹, NC, P(=O)(OR¹⁸)OR¹⁹, P¹⁸R¹⁹R²⁰, C(=O)R¹⁸, C(=NR¹⁸)R¹⁹, C(=NOR¹⁸)R¹⁹, C(=NNR¹⁸R¹⁹), C(=O)NR¹⁸R¹⁹, C(=O)NR¹⁸OR¹⁹, C(=O)NR¹⁸NR¹⁹R²⁰, C(=NRR¹⁸)NR¹⁹R²⁰, C(=NOR¹⁸)NR¹⁹R²⁰ or C(=O)NR¹⁸

wherein,
 R^{18} , R^{19} , R^{20} and R^{21} independently is H, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_3-C_7 cycloalkyl, C_3-C_7 cycloalkenyl, C_3-C_7 cycloalkoxy, aryl or heteroaryl and
 C_4-C_6 alkadienyl, C_3-C_7 cycloalkenealkyl, C_3-C_7 cycloalkenealkoxy, aryl or heteroaryl ring or R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{19} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring.

35

R^{18} , R^{19} and R^{20} independently is H, alkyl, alkenyl, alkynyl, alkadienyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of halogen, CN, CNO, C(halogen)s, OR²¹, OC(=O)OR²¹, OC(=O)OR²¹, OC(=O)NR¹⁹R²², SR²¹, S(=O)R²¹, S(=O)NR²¹R²², NO₂, N₃, NR²¹R²², NR²¹NR²², NR¹⁹NR²⁰, NR²¹C(=O)R²², NR²¹C(=O)OR²², NR²¹C(=O)NR²¹R²², NC, P(=O)(OR²¹)OR²², P(=O)R¹⁹R²⁰, C(=O)R²¹, C(=NR²¹)R²², C(=NOR²¹)R²², C(=NNR¹⁹R²²), C(=O)NR²¹R²², Cl(=ONR²¹)OR²², C(=NR¹⁹)NR¹⁹R²⁰ or C(=O)NR²¹NR²², wherein R¹⁸ and R¹⁹ may together form a 3-8 membered heterocyclic ring or R¹⁸ and R²⁰ may together form a 3-8 membered heterocyclic ring R¹⁹ and R²⁰ may together form a 3-8 membered heterocyclic ring, wherein, R²¹, R²² and R²³ independently is H, alkyl, alkenyl, alkynyl, alkadienyl, cycloalkyl, cycloheteroalkyl, aryl or heteroaryl and wherein R²¹ and R²² may together form a 3-membered heterocyclic ring or R²¹ and R²³ may together form a 3-8 membered heterocyclic ring or R²² and R²³ may together form a 3-8 membered heterocyclic ring.

In a further embodiment, R¹⁷ and R²⁴ independently is H, C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, C₄-C₈ alkenyl, C₃-C₇ cycloalkyl, C₃-C₇ cyclohexaheteroalkyl, aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of SnR¹⁸R¹⁹, Sn(OR¹⁸)R¹⁹⁻²⁰, Sn(OR¹⁸)OR¹⁹, BR¹⁸R¹⁹, B(OR¹⁸)R¹⁹, B(OR¹⁸)², halogen, CN, CNO, C(halogen)_n, OR¹⁸, OC(O)R¹⁸, OC(=O)OR¹⁸, OC(=O)C(=O)R¹⁸, Si(=O)R¹⁸, Si(=O)NR¹⁸, Si(=O)NR¹⁸R¹⁹, NO₂, N₃, NR¹⁸R¹⁹, OC(=O)NR¹⁸R¹⁹, SR¹⁸, S(=O)R¹⁸, S(=O)NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁸R¹⁹, NR¹⁸NR¹⁹R²⁰, NR¹⁸NC(=O)R¹⁹, NR¹⁸NC(=O)NR¹⁸R¹⁹, NR¹⁸C(=O)NR¹⁸R¹⁹, NC, R'(=O)(OR¹⁸)OR¹⁹, P¹⁸R¹⁹R²⁰, C(=O)R¹⁸, C(=NR¹⁸)R¹⁹, C(=NOR¹⁸)R¹⁹, C(=NNR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸R¹⁹, C(=O)NR¹⁸NR¹⁹R²⁰, C(=NOR¹⁸)NR¹⁹R²⁰ or R²¹.

wherein,
 R^{18} , R^{19} , R^{20} and R^{21} independently is H, $C_1\text{-}C_6$ alkyl, $C_2\text{-}C_6$ alkenyl, $C_2\text{-}C_6$ alkynyl, $C_4\text{-}C_6$ alkadienyl, $C_3\text{-}C_7$ cycloalkyl, $C_3\text{-}C_7$ cycloheteroalkyl, aryl or heteroaryl and wherein R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{19} and R^{20} may together form a 3-8 membered heterocyclic ring.

35

In still another embodiment heteroalkyl, aryl or heteroaryl and wherein R¹⁸ and R¹⁹ may together form a 3-8 membered heterocyclic ring or R¹⁸ and R²⁰ may together form a 3-8 membered heterocyclic ring or R¹⁸ and R²⁰ may together form a 3-8 membered heterocyclic ring.

R¹⁷ and R²⁴ independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl, aryl or heteraryl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, OC(=O)R¹⁸, OC(=O)OR¹⁹, OC(=O)NR¹⁸, SR¹⁸, Si(=O)R¹⁸, S(=O)NR¹⁸, NO₂, NR¹⁸R¹⁹, NR¹⁸OR¹⁹, NR¹⁸NR¹⁹R²⁰, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)OR¹⁹, NR¹⁸C(=O)NR¹⁹R²⁰, P(=O)(OR¹⁸)OR¹⁹, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸OR¹⁹, C(=O)NR¹⁸NR¹⁹R²⁰, C(=O)NR¹⁸NR¹⁹R²⁰, C(=NOR¹⁸)NR¹⁹R²⁰, C(=O)NR¹⁸NR¹⁹R²¹, wherein, R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cyclo-heteroalkyl, aryl or heteroaryl and wherein R¹⁸ and R¹⁹ may together form a 3-8 membered heterocyclic ring or R¹⁸ and R²⁰ may together form a 3-8 membered het-

In still another embodiment, R^{17} and R^{22} independently is H, C_1-C_6 alkyl, C_2-C_7 cycloalkyl, C_3-C_7 cyclo(heteroalkyl) aryl or heteroaryl, optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, Si=O|R¹⁸, Si=O|NR¹⁸, Si=O|R¹⁸ and R¹⁹

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SUBSTITUTE SHEET (9) II E 36)

42

43

NO_2 , $\text{NR}^{18}\text{R}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{R}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{NR}^{19}\text{R}^{20}$, $\text{C}(=\text{O})\text{R}^{18}$,

wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H , $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, $\text{C}_3\text{-C}_7$ cyclo-

heteroalkyl, aryl or heteroaryl and wherein R^{18} and R^{20} may together form a 3-8

membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered het-

erocyclic ring or R^{19} and R^{20} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,

R^{17} and R^{24} independently is H , methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl,

cyclopentyl, cyclohexyl, aziridinyl, pyrrolidinyl, piperidinyl, morpholinyl,

phenyl, naphthyl, thiényl, furyl, pyridyl, quinolinyll or isoquinolinyll optionally substituted

with one or more substituents selected from the group consisting of F , Cl , CN , CF_3 ,

OR^{18} , $\text{S}(=\text{O})\text{R}^{18}$, $\text{S}(=\text{O})_2\text{R}^{18}$, $\text{NR}^{18}\text{R}^{19}$, NO_2 , $\text{NR}^{18}\text{C}(=\text{O})\text{R}^{19}$,

$\text{NR}^{18}\text{C}(=\text{O})\text{OR}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{NR}^{19}\text{R}^{20}$, $\text{C}(=\text{O})\text{R}^{18}$, $\text{C}(=\text{O})\text{NR}^{19}\text{R}^{19}$, $\text{C}(=\text{O})\text{OR}^{18}$,

wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H , $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, $\text{C}_3\text{-C}_7$ cyclo-

heteroalkyl, aryl or heteroaryl and wherein R^{18} and R^{20} may together form a 3-8

membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered het-

erocyclic ring or R^{19} and R^{20} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,

R^{17} and R^{24} independently is H , methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl,

cyclopentyl or cyclohexyl optionally substituted with one or more substituents se-

lected from the group consisting of F , Cl , CN , CF_3 , OR^{18} ,

$\text{S}(=\text{O})_2\text{R}^{18}$, NO_2 , $\text{NR}^{18}\text{R}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{R}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{NR}^{19}\text{R}^{20}$,

$\text{C}(=\text{O})\text{R}^{18}$, $\text{C}(=\text{O})\text{NR}^{19}\text{R}^{19}$, $\text{C}(=\text{O})\text{OR}^{18}$, $\text{C}(=\text{O})\text{NR}^{19}\text{OR}^{19}$, $\text{C}(=\text{O})\text{OR}^{18}$,

wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H , $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, $\text{C}_3\text{-C}_7$ cyclo-

heteroalkyl, aryl or heteroaryl and wherein R^{18} and R^{19} may together form a 3-8

membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered het-

erocyclic ring or R^{19} and R^{20} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,

R^{17} , R^{19} , R^{20} and R^{21} independently is H , phenyl, naphthyl, furyl, pyridyl, quinolinyll or

isoquinolinyll optionally substituted with one or more substituents selected from the group

consisting of F , Cl , CN , CF_3 , OR^{18} ,

$\text{S}(=\text{O})_2\text{R}^{18}$, NO_2 , $\text{NR}^{18}\text{R}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{R}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{NR}^{19}\text{R}^{20}$,

$\text{C}(=\text{O})\text{R}^{18}$, $\text{C}(=\text{O})\text{NR}^{19}\text{R}^{19}$, $\text{C}(=\text{O})\text{OR}^{18}$, $\text{C}(=\text{O})\text{NR}^{19}\text{OR}^{19}$, $\text{C}(=\text{O})\text{OR}^{18}$,

wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H , phenyl or naphthyl optionally substituted with one or

more substituents selected from the group consisting of F , Cl , CN , CF_3 , OR^{18} ,

$\text{S}(=\text{O})_2\text{R}^{18}$, NO_2 , $\text{NR}^{18}\text{R}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{R}^{19}$, $\text{NR}^{18}\text{C}(=\text{O})\text{NR}^{19}\text{R}^{20}$,

$\text{C}(=\text{O})\text{R}^{18}$, $\text{C}(=\text{O})\text{NR}^{19}\text{R}^{19}$, $\text{C}(=\text{O})\text{OR}^{18}$, $\text{C}(=\text{O})\text{NR}^{19}\text{OR}^{19}$, $\text{C}(=\text{O})\text{OR}^{18}$,

wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H , $\text{C}_1\text{-C}_6$ alkyl, $\text{C}_3\text{-C}_7$ cycloalkyl, $\text{C}_3\text{-C}_7$ cyclo-

heteroalkyl, aryl or heteroaryl and wherein R^{18} and R^{19} may together form a 3-8

membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered hetero-

cyclic ring or R^{19} and R^{20} may together form a 3-8 membered heterocyclic ring,

46

wherein,
 R^{18} , R^{19} , R^{20} and R^{21} independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclopentyl, cyclohexyl, phenyl, naphthyl, thienvl, furyl, pyridinyl, quinolinyl or isoquinolinyl and wherein R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,

R^{17} and R^{24} independently is H, methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)NR¹⁸, NR¹⁸C(=O)OR¹⁹, NR¹⁸C(=O)NR¹⁹NR¹⁸, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁹OR¹⁸ or R^{21} , wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H, methyl, ethyl, propyl or butyl and wherein R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{21} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,
 R^{17} and R^{24} independently is H, azetidinyl, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)NR¹⁸, NR¹⁸C(=O)OR¹⁹, NR¹⁸C(=O)NR¹⁹OR¹⁸, NR¹⁸C(=O)NR¹⁹NR¹⁸, C(=O)R¹⁸, C(=O)NR¹⁸OR¹⁹, C(=O)NR¹⁸OR¹⁹OR¹⁸ or R^{21} , wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H, methyl, ethyl, propyl or butyl and wherein R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{21} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,
 R^{17} and R^{24} independently is H, thienvl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)NR¹⁸, NR¹⁸C(=O)OR¹⁹, NR¹⁸C(=O)NR¹⁹OR¹⁸, NR¹⁸C(=O)NR¹⁹NR¹⁸, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁹OR¹⁸ or R^{21} , C(=O)R¹⁸, C(=O)NR¹⁸OR¹⁹, C(=O)NR¹⁸OR¹⁹OR¹⁸ or R^{21} , wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H, methyl, ethyl, propyl or butyl and wherein R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{21} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,
 R^{17} and R^{24} independently is H, phenyl, naphthyl, thienvl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)NR¹⁸OR¹⁸,

35

47

NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)OR¹⁹, NR¹⁸C(=O)NR¹⁹R¹⁸, C(=O)R¹⁸,

C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸OR¹⁹, C(=O)NR¹⁸OR¹⁹ or R^{21} ,

wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H, methyl, ethyl, propyl or butyl and wherein R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{21} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,
 R^{17} and R^{24} independently is H, phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸,

S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)NR¹⁸R¹⁹, NO₂, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁹R¹⁸, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=O)NR¹⁸OR¹⁹,

C(=O)NR¹⁸OR¹⁹OR¹⁸ or R^{21} ,

wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H, methyl, ethyl, propyl or butyl and wherein R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{21} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,
 R^{17} and R^{24} independently is H, thienvl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)NR¹⁸OR¹⁸,

NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁹OR¹⁸, NR¹⁸C(=O)NR¹⁹NR¹⁸, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁹OR¹⁸ or R^{21} , C(=O)R¹⁸, C(=O)NR¹⁸OR¹⁹, C(=O)NR¹⁸OR¹⁹OR¹⁸ or R^{21} ,

wherein,

R^{18} , R^{19} , R^{20} and R^{21} independently is H, methyl, ethyl, propyl or butyl and wherein R^{18} and R^{19} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{20} may together form a 3-8 membered heterocyclic ring or R^{18} and R^{21} may together form a 3-8 membered heterocyclic ring,

In still another embodiment,
 R^{17} and R^{24} independently is methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)NR¹⁸OR¹⁸,

35

lected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)₂NR¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)OR¹⁹, NR¹⁸RC(=O)NR¹⁹ or R²¹, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸OR¹⁹ or R²¹, wherein,

5 R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another embodiment,

R¹⁷ and R²⁴ independently is aziridinyl, azetidinyl, pyrrolidinyl, piperidinyl or morpholinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)₂NR¹⁹R¹⁹, NO₂, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)OR¹⁹, NR¹⁸RC(=O)R¹⁹, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸OR¹⁹ or R²¹,

wherein,

R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another embodiment,

R¹⁷ and R²⁴ independently is phenyl, naphthyl, thiophenyl, furanyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)₂NR¹⁹R¹⁹, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸RC(=O)OR¹⁹, NR¹⁸RC(=O)NR¹⁹R²⁰, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸R¹⁹, C(=O)NR¹⁸OR¹⁹ or R²¹,

wherein,

R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another embodiment,

R¹⁷ and R²⁴ independently is aziridinyl, azetidinyl, pyrrolidinyl, piperidinyl, morpholinyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)₂NR¹⁹R¹⁹, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸RC(=O)OR¹⁹, NR¹⁸RC(=O)NR¹⁹R²⁰, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸R¹⁹, C(=O)NR¹⁸OR¹⁹ or R²¹,

wherein,

R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another embodiment,

R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another embodiment,

5 R¹⁷ and R²⁴ independently is thienyl, furyl, pyridyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)₂NR¹⁹R¹⁹, NO₂, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)OR¹⁹, NR¹⁸C(=O)NR¹⁹R²⁰, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸OR¹⁹ or R²¹,

wherein,

10 R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl,

In still another embodiment,

15 R¹⁷ and R²⁴ independently is methyl, ethyl, propyl, butyl, cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)₂NR¹⁹R¹⁹, NO₂, NR¹⁸C(=O)R¹⁹, NR¹⁸RC(=O)OR¹⁹, NR¹⁸RC(=O)NR¹⁹R²⁰, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸R¹⁹, C(=O)NR¹⁸OR¹⁹ or R²¹,

wherein,

20 R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, phenyl, naphthyl, thiophenyl, furyl, pyridiny, quinolinyl or isoquinolinyl,

In still another embodiment,

25 R¹⁷ and R²⁴ independently is aziridinyl, azetidinyl, pyrrolidinyl, piperidinyl, morpholinyl or cyclohexyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, S(=O)R¹⁸, S(=O)₂R¹⁸, S(=O)₂NR¹⁹R¹⁹, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸RC(=O)OR¹⁹, NR¹⁸RC(=O)NR¹⁹R²⁰, C(=O)R¹⁸, C(=NOR¹⁸)R¹⁹, C(=O)OR¹⁸, C(=O)NR¹⁸R¹⁹, C(=O)NR¹⁸OR¹⁹ or R²¹,

wherein,

30 R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, phenyl, naphthyl, thiophenyl, furyl, pyridiny, quinolinyl or isoquinolinyl,

In still another embodiment,

50

R^{17} and R^{24} independently is phenyl, naphthyl, thiencyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, Si=O)R¹⁸, S(O)R¹⁸, S(O)₂R¹⁸, S(O)₂NR¹⁸R¹⁹, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁹R²⁰, C(=O)R¹⁸, C(=O)NR¹⁹R¹⁹, C(=O)NR¹⁹R²⁰, R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, phenyl, naphthyl, thiencyl, furyl, pyridyl, quinolinyl or isoquinolinyl,

wherein,
 R^{18} , R^{19} , R^{20} and R^{21} independently is H, phenyl, naphthyl, thiencyl, furyl, pyridyl, quinolinyl or isoquinolinyl.

10 In still another embodiment,
 R^{17} and R^{24} independently is phenyl or naphthyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, Si=O)R¹⁸, S(O)R¹⁸, S(O)₂NR¹⁸R¹⁹, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁹R²⁰, C(=O)R¹⁸, C(=O)NR¹⁸R¹⁹, C(=O)NR¹⁸R²⁰, C(=O)OR¹⁸, C(=O)NR¹⁹OR¹⁸ or R²¹,

15 wherein,
 R^{18} , R^{19} , R^{20} and R^{21} independently is H, phenyl, naphthyl, thiencyl, furyl, pyridyl, quinolinyl or isoquinolinyl,

20 In still another embodiment,
 R^{17} and R^{24} independently is thiencyl, furyl, pyridyl, quinolinyl or isoquinolinyl optionally substituted with one or more substituents selected from the group consisting of F, Cl, CN, CF₃, OR¹⁸, Si=O)R¹⁸, S(O)R¹⁸, S(O)₂NR¹⁸R¹⁹, NO₂, NR¹⁸R¹⁹, NR¹⁸C(=O)R¹⁹, NR¹⁸C(=O)NR¹⁹, NR¹⁸C(=O)NR¹⁹R²⁰, C(=O)R¹⁸, C(=O)NR¹⁸R¹⁹, C(=O)NR¹⁸R²⁰, C(=O)OR¹⁸, C(=O)NR¹⁹OR¹⁸, C(=O)NR¹⁹R²⁰, R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H, phenyl, naphthyl, thiencyl, furyl, pyridyl, quinolinyl or isoquinolinyl,

25 In still another embodiment,
 R^{17} and R^{24} independently is H, phenyl, naphthyl, thiencyl, furyl, pyridyl, quinolinyl or isoquinolinyl or isoquinolinyl,

30 In still another embodiment,
 R^{17} and R^{24} independently is H, C₁-C₆ alkyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl, R¹⁸, R¹⁹, R²⁰ and R²¹ independently is H,

35 wherein,
 R^{18} , R^{19} , R^{20} and R^{21} independently is H,

51

In still another embodiment,
 R^{17} and R^{24} independently is C₁-C₆ alkyl, C₃-C₇ cycloalkyl or C₃-C₇ cycloheteroalkyl,

In still another embodiment,
 R^{17} and R^{24} independently is methyl, ethyl, propyl or butyl

In still another embodiment,
 R^{17} and R^{24} independently is cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl

In still another embodiment,
 R^{17} and R^{24} independently is cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl

In still another embodiment,
 R^{17} and R^{24} independently is azidinyl, pyrrolidinyl, piperidinyl or morpholinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

In still another embodiment,
 R^{17} and R^{24} independently is thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl

In still another embodiment,
 R^{17} and R^{24} independently is azidinyl, pyrrolidinyl, piperidinyl or morpholinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

In still another embodiment,
 R^{17} and R^{24} independently is thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

In still another embodiment,
 R^{17} and R^{24} independently is thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

In still another embodiment,
 R^{17} and R^{24} independently is thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

In still another embodiment,
 R^{17} and R^{24} independently is thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

In still another embodiment,
 R^{17} and R^{24} independently is thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

In still another embodiment,
 R^{17} and R^{24} independently is thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

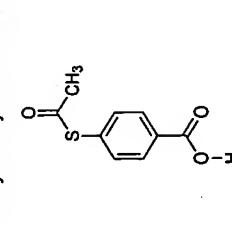
In still another embodiment,
 R^{17} and R^{24} independently is thienyl, furyl, pyridyl, quinolinyl or isoquinolinyl

In still another embodiment,
 R^{17} and R^{24} independently is aryl or heteroaryl

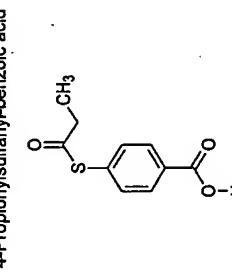
In still another embodiment,
 R^{17} and R^{24} independently is phenyl or napthyl

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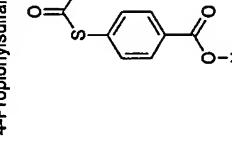
was redissolved in EtOAc (10 mL), washed with water and brine. The organic phase was dried over MgSO₄, and evaporated *in vacuo*. The pure product was obtained by silica gel purification using a gradient of heptane to EtOAc as eluent.

Example 1 (General procedure 1, wherein Z=S, R'=H, and R=CH₃)

Yield = 70%: ¹H-NMR (DMSO-d₆): 8.00 (d, 2H); 7.55 (d, 2H); 2.46 (s, 3H).

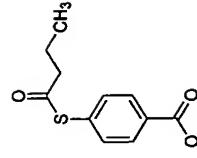
Example 2 (General procedure 1, wherein Z=S, R'=H, and R=CH₂CH₃)

Yield = 85%: ¹H-NMR (CDCl₃): 8.12 (d, 2H); 7.58 (d, 2H); 2.76 (q, 2H); 1.28 (t, 3H).

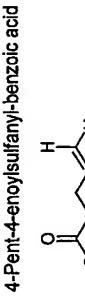
Example 3 (General procedure 1, wherein Z=S, R'=H, and R=(CH₂)₂CH₃)

Yield = 95%: ¹H-nmr (CDCl₃): 8.20 (d, 1H); 8.05 (dd, 1H); 7.25 (d, 1H); 2.40 (s, 3H).

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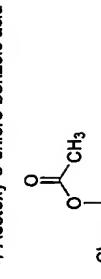


Yield = 98%: ¹H NMR (CDCl₃): 8.15 (d, 2H); 7.56 (d, 2H); 2.70 (t, 2H); 1.81 (sixet, 2H); 1.04 (t, 3H).

Example 4 (General procedure 1, wherein Z=S, R'=H, and R=(CH₂)₂CHCH₂)

Yield = 71%: ¹H-NMR (CDCl₃): 8.15 (d, 2H); 7.55 (d, 2H); 5.85 (m, 1H); 5.11 (dd, 2H); 2.82 (t, 2H); 2.47 (q, 2H).

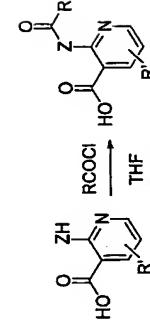
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Example 5 (General procedure, wherein Z=O, R'=Cl, and R=CH₃)

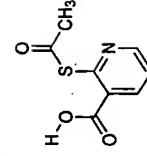
Yield = 95%: ¹H nmr (CDCl₃): 8.20 (d, 1H); 8.05 (dd, 1H); 7.25 (d, 1H); 2.40 (s, 3H).

15

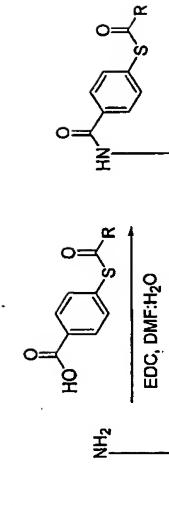
54

General Procedure 2: Synthesis of nicotinic acid derivative for building blocks:**Example 5 (General procedure 2)** wherein Z=S, R=H, and R'=CH₃

5 amine (5 mL). The mixture was cooled to 0°C and treated with an acid chloride (12.88 mmol). The cooling bath was removed and the reaction mixture was stirred overnight at rt. After removal of the solvents, toluene (10 mL) was added to the crude and evaporated *in vacuo*. The pure product was obtained by silica gel purification using a gradient starting from dichloromethane going to 2% methanol in dichloromethane as eluent.

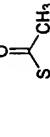
Example 6 (General procedure 2), wherein Z=S, R=H, and R'=CH₃**2-Acetylisulfanyl-nicotinic acid**Yield = 5%; ¹H-NMR (CDCl₃): 8.76 (dd, 1H); 8.64 (dd, 1H); 7.40 (dd, 1H); 2.79 (s, 3H).

General Procedure 3: Preparation of building blocks by loading a Carrier-Functional entity ensemble onto an oligonucleotide comprising an amino group:



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Example 7 (General procedure (3))
Oligo A loaded with compound of Example 1

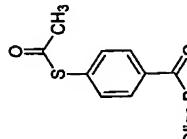


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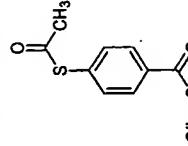
MS (calc., M-1) = 11.560, 87; MS (found) = 11.557, 89

Example 8 (General procedure (3))
Oligo B loaded with compound of Example 1

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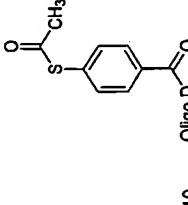


Example 9 (General procedure (3))
Oligo C loaded with compound of Example 1



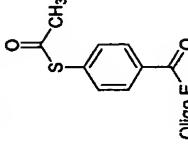
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Example 10 (General procedure (3))
Oligo D loaded with compound of Example 1



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Example 11 (General procedure (3))
Oligo E loaded with compound of Example 1

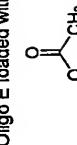


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MS (calc., M-1) = 4069,84; MS (found) = 4070,20

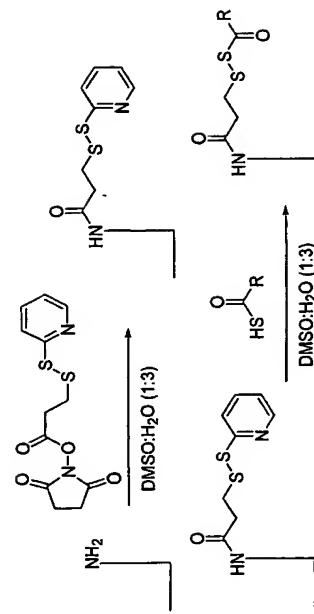
Example 12 (General procedure (3))

Oligo E loaded with compound of Example 5



General Procedure 4: Preparation of building blocks by step wise loading of a carrier and a functional entity onto an oligonucleotide containing a nucleotide derivative comprising an amino group:

10



15

40 μ L of a 20 mM SPDP solution in DMSO was mixed with an aminooligo (5 nmol), 200 mM HEPES buffer pH 7.5 was added (80 μ L) and water to a final volume of 160 μ L. The reaction mixture was left for 2 hours at 30°C. The excess building block was removed by extraction with EtOAc (500 μ L). Remaining EtOAc was removed in

¹ The difference observed in the calculated and found MS of around 16 is probably due to an oxidation of the sulphur atom of the biotin moiety

58

vacuo by spinning 10 min in a speedvac. The SPD_P activated amino oligo was purified using a micro bio-spin column (equilibrated with 200 mM HEPES buffer pH 7.5). 10 μ L of a 50 mM thio derivat solution in DMSO was added to the purified SPD_P activated amino oligo solution and the reaction mixture was left for 30 min at 20 °C. The building block loaded amino oligo was ethanol precipitated twice using NH₄OAc and analysed by electron spray mass spectrometry (ES-MS).

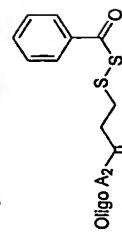
Amino oligo used:

10 A2: 5'-GACTCTGTGAGCATCCAGCTTATGGGAATTCCCTCGTCCACAAATGZ

Z = Amino-Modifier C6 dT phosphate (Glen# 10-1039-)

Example 13 (General procedure (4))

Oligo A2 loaded with thiobenzoic acid

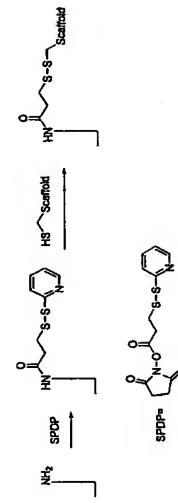


15 MS (calc., M-1) = 14518.76; MS (found) = 14516.78

Example 14: Loading of a trisamine scaffold on an oligonucleotide containing a nucleotide derivative comprising an amino group:

A hexameric scaffold peptide with the sequence, CysPhePhylsLysLys, was synthesised by standard solid-phase peptide chemistry. The scaffold peptide comprises a -SH group on the cystein side chain, said -SH group being used for coupling the scaffold peptide to a amine-bearing oligonucleotide serving as anti-codon and linker. Each of the three lysin moieties comprises an amino group in the side chain. The amine groups are used as reactive groups for the formation of a connection to functional entities emanating from building blocks. The N-terminus of the peptide was acetylated and the C-terminus was initially capped as an amide to avoid any participation in the reactions to follow and subsequently purified by reverse phase-HPLC. The scaffold peptide was covalently attached to DNA oligonucleotide using the scheme shown schematically below. For illustrative purposes, the scaffold is indicated as HS—Scaffold

59



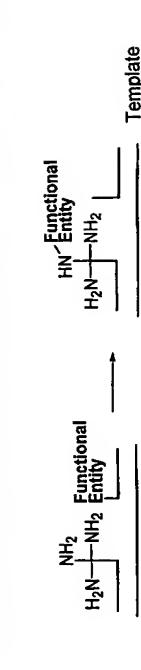
5 nmol of oligodeoxyribonucleotide F: 5'-XTCGTAACGACTGAATGACGT where X = 5

5 amino C8 (Glen# 10-1906-90) in 100 mM Hepes-OH pH 7.5 is incubated with 20 mM Succinimidyl-propyl-2-dithiopyridyl (SPDP, Molecular probes) dissolved in DMSO for 3 hours at 25 °C. Excess SPDP is removed by triple extraction using 5 volumes of ethylacetate. The sample is further purified using a Bio-rad Microspin 6 column equilibrated in H₂O.

10 The oligonucleotide-scaffold conjugate is synthesised by incubating 1 μ mol hexapeptide with 5 nmol SPDP activated oligonucleotide in 100 mM Hepes-OH pH 7.5 for 2 hours at 25 °C. Excess peptide is removed by double sodium-acetate/ethanol precipitation of the scaffold-DNA complex according to standard procedure. The loading was verified by Electrospray Mass Spectrometry (ES-MS).

15 Loading of trisamine scaffold on oligo F: MS (calc., M-1) = 7247.45 MS (found) = 7244.80

Example 15: Transfer of a functional entity from a building block to a scaffold:



A template oligo G: 5'-ACGTCAATTCTAGTTACGAACTGGATTGCTCCAGG TCAG (1 nmol) was mixed with scaffold oligo F (1.5 nmol) in MES-buffer (20 μ L of a 100 mM MES, pH=6) and water (added to a final volume of 100 μ L). Scaffold oligo F was annealed to the template by heating to 80 °C and cooled (-2 °C/ 10 second) to room temperature and functional entity oligo E (Example 11) (1.5 nmol) was added. The mixture was left *o/n* at room temperature. The oligo complex was attached to

streptavidine by addition of streptavidine sepharose beads (50 μ L, prewashed with 2x1 mL 100 mM MES buffer, pH=5). The beads were washed with water (4 x 200 μ L). Oligo F was separated from the streptavidine bound complex by addition of water (200 μ L) followed by heating to 80 °C for 5 minute. The beads were filtered off and the water was evaporated. Oligo F was redissolved in water and building block transfer verified by electron spray mass spectrometry (ES-MS).

Transfer of acetyl to trisamine scaffold oligo F from example 1 attached to oligo E:

MS (calc.) = 7289.49; MS (found) = 7286.58

10

Section 3: Transfer efficiencies of functional entities from building blocks to amine scaffolds

Carrier coupled functional entities were loaded onto oligos (oligonucleotides) containing a nucleotide derivative comprising an amino group (General procedure 5) or a nucleotide derivative comprising a thiol (General procedure 6) and the transfer was conducted to a scaffold oligo with a nucleotide derivative comprising an amino group. Transfer efficiencies were analyzed by ES-MS (electrospray mass spectroscopy) (General procedure 7).

General Procedure 5: Loading of a carrier coupled functional entity onto an amino oligo:

25 μ L 100 mM carrier coupled functional entity dissolved in DMF (dimethyl formamide) was mixed with 25 μ L 100 mM EDC (1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride) in DMF for 30 minutes at 25° C. The mixture was added to 50 μ L amino oligo in H₂O with 100 mM HEPES (2-[14-(2-hydroxy-ethyl)-piperazin-1-yl]-ethanesulfonic acid) pH 7.5 and the reaction was allowed to proceed for 20 minutes at 25° C. Unreacted carrier coupled functional entity was removed by extraction with 500 μ L EtOAc (ethyl acetate), and the oligo was purified by gel filtration through a microspin column equilibrated with 100 mM MES (2-(N-morpholino) ethanesulfonic acid) pH 6.0.

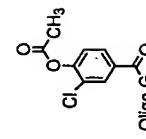
Oligonucleotide used:

Oligo G: 5'-GCGACCTGGAGCATCCATCGY

Y = Amino-Modifier C2 dT phosphate (Gen# 10-1037)

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streptavidine by addition of streptavidine sepharose beads (50 μ L, prewashed with 2x1 mL 100 mM MES buffer, pH=5). The beads were washed with water (4 x 200 μ L). Oligo F was separated from the streptavidine bound complex by addition of water (200 μ L) followed by heating to 80 °C for 5 minute. The beads were filtered off and the water was evaporated. Oligo F was redissolved in water and building block transfer verified by electron spray mass spectrometry (ES-MS).



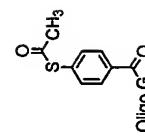
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Carrier coupled functional entity: 4-Acetoxy-3-chloro-benzolic acid

Example 16 (General procedure 5, using compound of Example 5 as carrier coupled functional entity)

Example 17 (General procedure 5, using compound of example 1 as carrier coupled functional entity)

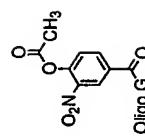
Carrier coupled functional entity: 4-Acetyl-sulfanyl-benzolic acid



10

Mass: 6738.23 (observed using ES-MS); 6738.31 (calculated) (The carrier coupled functional entity oligo is hydrolyzed in the mass spectrometer during analysis).

Example 18 (General procedure 1, wherein Z=O, R'=NO₂, and R=CH₃ and general procedure 5)



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Carrier coupled functional entity: 4-Acetoxy-3-nitro-benzolic acid

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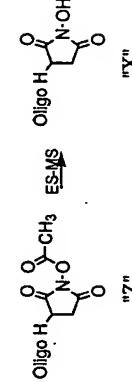
Mass: 6748.31 (observed using ES-MS), 6748.42 (calculated) (The carrier coupled functional entity oligo is hydrolyzed in the mass spectrometer during analysis).

- General Procedure 6: Loading of a carrier coupled functional entity onto a thiol oligo:**
- 5 10 nmol thiol oligo was lyophilized and redissolved in 50 μ l H₂O with 100 mM dithio-threitol and 100 mM sodium phosphate pH 8.0 and incubated at 37 °C for 1 hour.
- The reduced oligo was purified using a microspin column equilibrated with HEPES (100 mM, (100 mM, pH 7.5). Then 100 mM NHM (N-hydroxymaleimide) in HEPES (100 mM, pH 7.5) was added to the thiol oligo and the mixture was incubated at 25°C for 2 hours. The resulting NHS (N-hydroxysuccinimide)-oligo was purified using a microspin column equilibrated with H₂O. 1 nmol NHS-oligo was lyophilized and redissolved in 10 μ l 100 mM MES, pH 6. 50 μ l carrier coupled functional entity (100 mM) in dimethylformamide was activated with 50 μ l 100 mM EDC in DMF for 30 min at 25 °C. 10 μ l of the EDC-activated carrier coupled functional entity was mixed with the NHS-oligo and incubated for 5 min at 25 °C. 30 μ l 100 mM MES pH 6 was added and following an extraction with 500 μ l EtOAc the oligo was purified using a microspin column equilibrated with 100 mM MES pH 6.

Oligo H: 5'-GCGACCTGAGCATCCATGTX

20 X = Thiol-Modifier C6 S-S (Glen# 10-1936)

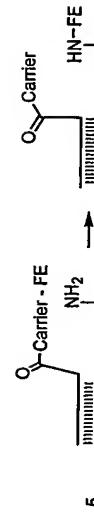
Example 19 (General procedure 6)



25 Mass "X": 6723.21 (observed using ES-MS), 6723.52 (calculated) (Compound "Z" is hydrolyzed to compound "X" in the mass spectrometer during analysis).

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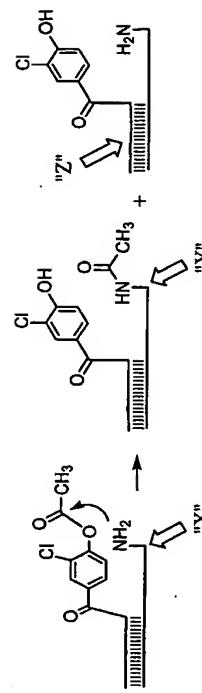
General procedure 7: Transfer of functional entity from a carrier oligo to a scaffold oligo.



Scaffold oligo I: 5'-ZACGATGGATGCTCCAGGTGCC
Z = 5' Amino-modifier C6 (Glen Research cat. # 10-1906)

- 10 A carrier coupled functional entity oligo (Examples 16, 17, 18, 19) (250 pmol) was added to a scaffold oligo I (200 pmol) in 50 μ l 100 mM MES, pH 6. The mixture was incubated overnight at 25 °C. Subsequently, the mixture was purified by gel filtration using a microspin column equilibrated with H₂O and transfer of the functional entity was verified by electron spray mass spectrometry (ES-MS). Transfer efficiencies are expressed in percent and were calculated by dividing the abundance of scaffold oligo carrying transferred functional entities to total abundance of scaffold oligos (with and without transferred functional entities).

Example 20 (General procedure 7):



- 10 Mass ("X"): 6624.70 (observed), 6625.42 (calculated), Abundance: 73.16 (arbitrary units)
Mass ("Y"): 6666.09 (observed), 6667.46 (calculated), Abundance: 26.15 (arbitrary units)
Mass ("Z"): 6738.01 (observed), 6738.31 (calculated) (carrier coupled functional entity oligos are hydrolyzed in the mass spectrometer during analysis).

64

Transfer efficiency calculated as: 26.15 / (26.15 + 73.16) = 0.2633 ~ 26 %

Transfer efficiencies:

5

Scaffold oligo	Building block oligo
-------------------	----------------------

Example 16	Example 17	Example 18	Example 19
Oligo G-C-O	Oligo S-C(CH ₃) ₂ -O	Oligo O-C(CH ₃) ₂ -N(O)-O-C(=O)-CH ₃	Oligo H-C(=O)-O-N(O)-C(=O)-CH ₃
26	32	>60	58

Example 21: Stability of building block oligonucleotides during storage and handling

Carrier coupled functional entities were loaded onto oligonucleotides containing a nucleotide derivative comprising an amino group (General Procedure 7). The resulting carrier coupled functional entity oligos were either mixed immediately with scaffold oligo 1 at 25°C (condition 1) or subjected to different conditions before mixing: (condition 2) -80°C for 14 days, (condition 3) 25°C for 1 hour. For condition 4 the scaffold oligo and the building block oligo were heated to 80°C for 30 seconds, mixed, and then cooled to 25°C (~5°C / minute). The functional entity of the building block oligo was transferred to a scaffold oligo by incubation at 25°C overnight and analyzed by ES-MS (General procedure 3).

Transfer efficiencies (in percent) in reactions involving the same building block were normalized to facilitate comparison, e.g. the observed transfer efficiency when scaffold oligo was mixed with building block oligo immediately after production was set to 100:

Condition	Description	Ex. 16	Ex. 17	Ex. 18	Ex. 19
1	Immediate mixing	100	100	100	100
2	-80°C for 14 days	96	97	89	92
3	25°C for 1 hour	97	98	93	71
4	From 80°C to 25°C	106	105	87	60.5

The results indicate that all the building blocks may be stored in a freezer at -80°C for several weeks without losing significant reactivity. Under practical handling conditions at room temperature the NHS ester of example 19, which is not according to the invention, looses a considerable amount of reactivity. The tendency of spontaneous hydrolysis of the building block according to example 18 is reinforced under the condition simulating an actual experiment (condition 4), while the building blocks of example 16 to 18 have an acceptable stability or even a slightly increased activity. Activities above 100 observed under condition 4 might be due to experimental variation or facilitation of annealing of the carrier coupled functional entity oligo and scaffold oligo at elevated temperatures.

Example 22: Preparation of Building blocks.

The following oligo containing a nucleobase modified with an amino group was synthesised, using the conventional phosphoramidite approach:

20 Example 22: Preparation of Building blocks.

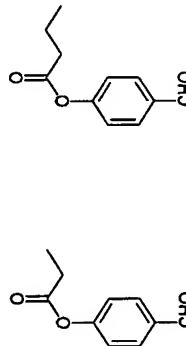
21 N: 5'-ZGT AAC ACC TGT GTA AGC TGC CTG TCA GTC GGT ACT GAC CTG TCG AGC ATC CAG CT

Z depicts the nucleobase modified with an aminogroup, incorporated using the commercially available amino modifier C6 dT phosphoramidite (10-1039-90 from Glen research)

22 The loading with a functional entity proceeds using the general method:
An amino oligo (3 pmol) was mixed with a phosphate buffer (3 uL of a 0.1 M solution, pH=6) and NaBH₃CN (3 uL of a 1 M solution in MeOH). A chemical entity com-

prising the functional entity (3 μ L of a 1 M solution in MeOH) was added and the mixture was left on at room temperature. The product formation was analysed by PAGE gel.

Exemplary chemical entities are 4-acetoxybenzaldehyde (24,260-8 from Sigma-Aldrich),



Propionic acid 4-formyl-phenyl ester, Butanoic acid 4-formyl-phenyl ester

Figure 5 shows a PAGE analysis of the loading of an oligo with butanoic acid 4-formyl-phenyl ester. Lane 1 shows the reference amino oligo (N). Lane 2 show the amino oligo (N) after loading with a the chemical entity comprising the functional entity, and Lane 3 shows removal of the functional entity, attached in lane 2, by treatment with pH=11 for 1 hour.

The above examples are intended to help illustrate the invention, and are not intended to, nor should they be construed to, limit the scope of the invention. Indeed, various modifications of the invention and many further embodiments thereof, in addition to those shown and described herein, will become apparent to those skilled in the art from the full content of this document, including the examples shown above and the references to the scientific a patent literature cited herein. It should further be appreciated that the contents of those cited references are incorporated herein by reference to help illustrate the state of the art. The examples above contain important additional information that can be adapted to the practice of this invention in its various embodiments and the equivalents thereof.

Abbreviations

DCC	N,N'-Dicyclohexylcarbodiimide
DhI OH	3,4-dihydro-3-hydroxy-4-oxo-1,2,3-benzotriazine
DIC	Diisopropylcarbodiimide
DIEA	Diethylisopropylamin
DMAP	4-Dimethylaminopyridine
DNA	Deoxyribonucleic Acid
EDC	1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide-HCl
HATU	2-(1H-7-Azabenzotriazole-1-y)-1,1,3-tetramethyluronium hexafluorophosphate
HBTU	2-(1H-Benzotriazole-1-y)-1,1,3-tetramethyluronium hexafluoro-phosphate
HOAt	N-Hydroxy-7-azabenzotriazole
HOBr	N-Hydroxybenzotriazole
LNA	Locked Nucleic Acid
NHS	N-hydroxysuccinimid
OTf	Trifluoromethylsulfonate
OTs	Toluenesulfonate
PNA	Peptide Nucleic Acid
PyBOP	Benzotriazole-1-y-oxy-tris-pyrrolidino-phosphonium hexafluoro-phosphate
PyBroP	Bromo-tris-pyrrolidino-phosphonium hexafluorophosphate
RNA	Ribonucleic acid
TBTU	2-(1H-Benzotriazole-1-y)-1,1,3-tetramethyluronium tetra-fluoroborate
TEA	Triethylamine
RP-HPLC	Reverse Phase High Performance Liquid Chromatography
TBDMS-Cl	Tert-Butyldimethylsilylchloride
S-iodo-dU	5-iodo-deoxyriboseuracil
TLC	Thin layer chromatography
(Boc) ₂ O	Boc anhydride, di- <i>t</i> -butyl dicarbonate
TBAF	Tetrabutylammonium fluoride
SPDP	Succinimidyl-propyl-2-dithiopyridyl

INTERNATIONAL SEARCH REPORT

PCT/DK 03/00174

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
WO 9807734	A	26-02-1998	AU	4156197 A 9807734 A1		06-03-1998 26-02-1998
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			WO	200205623 A1		09-05-2002
			WO	0003896 A1		20-01-2000
			US	2003149260 A1		07-08-2003
			US	6399756 B1		04-06-2002
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			WO	9640710 A1		19-12-1996
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			WO	0014102 A1		16-03-2000

INTERNATIONAL SEARCH REPORT

PCT/DK 03/00174

International Application No. PCT/DK 03/00174

Continuation of Box I.2
Claims Nos.: 1-25 (in part)

Present claims 1-25 relate to an extremely large number of possible building blocks. In fact, the claims contain so many options that a lack of clarity within the meaning of Article 6 PCT arises to such an extent as to render a meaningful search of the claims impossible. Moreover, support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT is to be found for only a very small proportion of the building blocks claimed. Consequently, the search has been carried out for those parts of the application which do appear to be clear and supported, namely those parts of the application relating to the building blocks of claim 1 where the complementing element is a nucleic acid or a derivative thereof as in claims 16 and 17 AND where the C-F connecting group is as defined in claim 15.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an [international] preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

PCT/DK 03/00174

C(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WALDER J A ET AL: "COMPLEMENTARY CARRIER PEPTIDE SYNTHESIS: GENERAL STRATEGY AND IMPLICATIONS FOR PREBIOTIC ORIGIN OF PEPTIDE SYNTHESIS" PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF USA, NATIONAL ACADEMY OF SCIENCE, WASHINGTON, US, vol. 76, no. 1, January 1979 (1979-01), pages 51-55, XPO00857351 ISSN: 0027-8424 the whole document	22
A	BRUICK R K ET AL: "TEMPLATE-DIRECTED LIGATION OF PEPTIDES TO OLIGONUCLEOTIDES" CHEMISTRY AND BIOLOGY, CURRENT BIOLOGY, LONDON, GB, vol. 3, no. 1, January 1996 (1996-01), pages 49-56, XPO00856876 ISSN: 1074-5521 the whole document	22
A	US 5 693 773 A (AGRAWAL SUDHIR ET AL) 2 December 1997 (1997-12-02) figure 11	1
A	WO 00 14102 A (FUJISAWA KAZUHIKO ; JAPAN SCIENCE & TECH CORP (JP); MAKATANI KAZUHI) 16 March 2000 (2000-03-16) abstract	1

PCT/DK 03/00174

INTERNATIONAL SEARCH REPORT

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6(4)(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claim; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.

- No protest accompanied the payment of additional search fees.

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Minimum documentation searching (classification system followed by classification symbols)

IPC 7 C07H

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C07H 21/00

HUSEMOEN, Gitter, Nystrup (DK/DK); Brønsgaard, 18, 1.ub., DK-2200 København N (DK). FRANCH, Thomas (DK/DK); Humpelsgade 14, st. n°, DK-2200 København N (DK). THISTED, Thomas I (DK/DK); Fjordkærhaven 14, DK-3600 Frederiksund (DK).

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(71) Applicant (for all designated States except US): NUVEOLUTION A/S (DK/DK); Rønnevej 8, 5th floor, DK-2100 Copenhagen Ø (DK).

(72) Inventors and

(73) Inventors/Applicants (for US only): GOULIAEV, Alex, Haahr (DK/DK); Brønded 223, DK-3670 Værsø

Sjælland (DK). HO, Justin (US/DK); Mattræsgade 50, 3-26, DK-1666 København V (DK). FELDING, Jakob (DK/DK); Odorphøjvej 24, 1., DK-2920 Charlottenlund (DK). SAMS, Christian (DK/DK); Jacob Danmarksvej 4A, 1., DK-1973 Frederiksberg C (DK). PEDERSEN, Henrik (DK/DK); Frødsvej 24, DK-2860 Bagsværd (DK). JENSEN, Kim, Birkebæk (DK/DK); Vollumvej 30C, DK-2610 Rødvore (DK). HANSEN, Anders, Holm (DK/DK); Slagelsevej 3, st. llh., DK-2400 København NV (DK). LUNDØRE, Mikkel Dybro (DK/DK); Charlotte Muntsevej 31, 2. v., DK-2400 København NV (DK).

(44) Inventor's/Assignee's address:

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— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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For two-letter codes and other abbreviations, refer to the Guidance Notes on Codes and Abbreviations appearing at the beginning of each regular issue of the PCT Gazette.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category • Citation of document, with indication, where appropriate, of the relevant passages

X WO 98 07734 A (HYBRIDON INC)

figures 26 February 1998 (1998-02-26)

X US 6 326 478 B1 (CHERUVALLATH ZACHARIA S ET AL.) 4 December 2001 (2001-12-04)

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INTERNATIONAL SEARCH REPORT

PCT/DK 03/00174

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C07H21/00

B. FIELDS SEARCHED

Minimum documentation searching (classification system followed by classification symbols)

IPC 7 C07H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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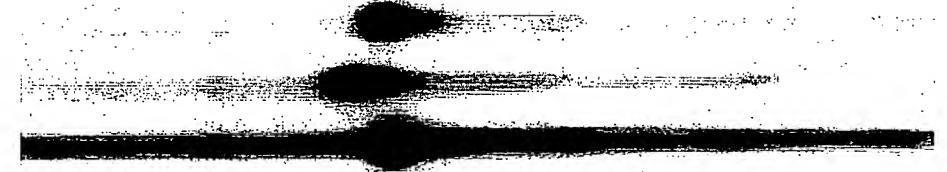
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Fig. 5



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Fig. 6

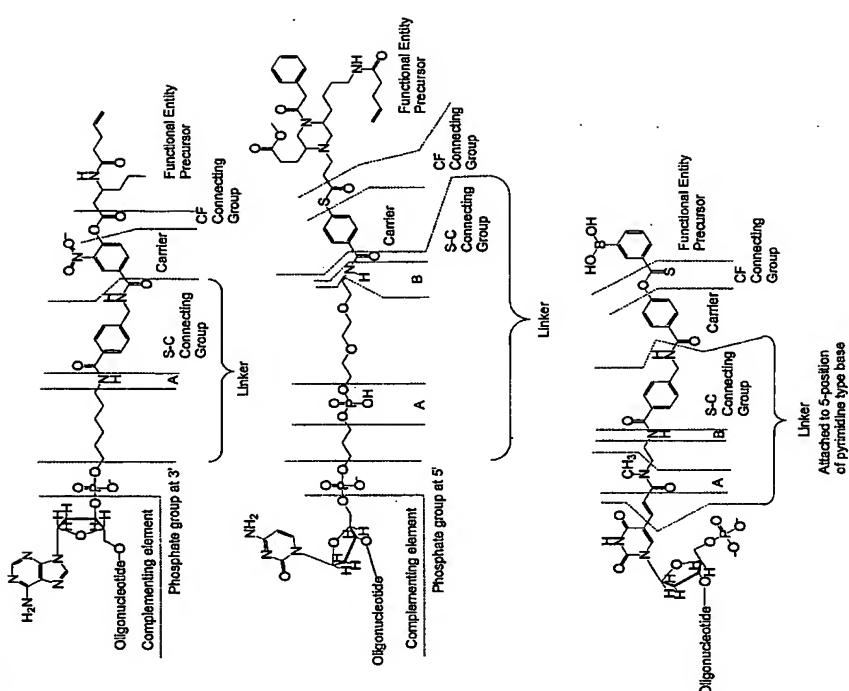
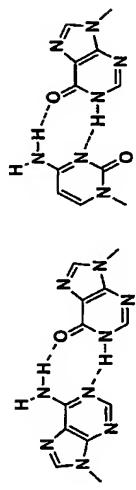
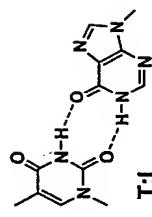


Fig. 3.

Inosine = I

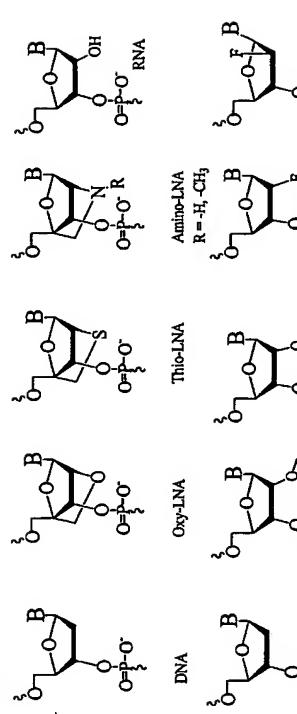


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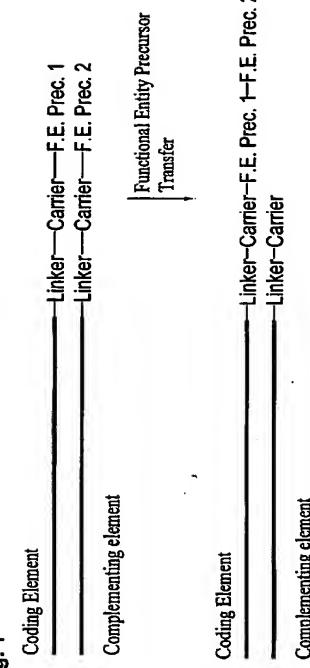
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Fig. 4

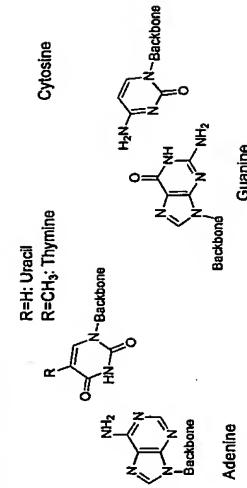


 Morpholine	 PNA	 TNA
 CenA	 Boronophosphates	 3-Phosphoramidate
 HNA	 2'-AP	 2-(3-hydroxypropoxy)

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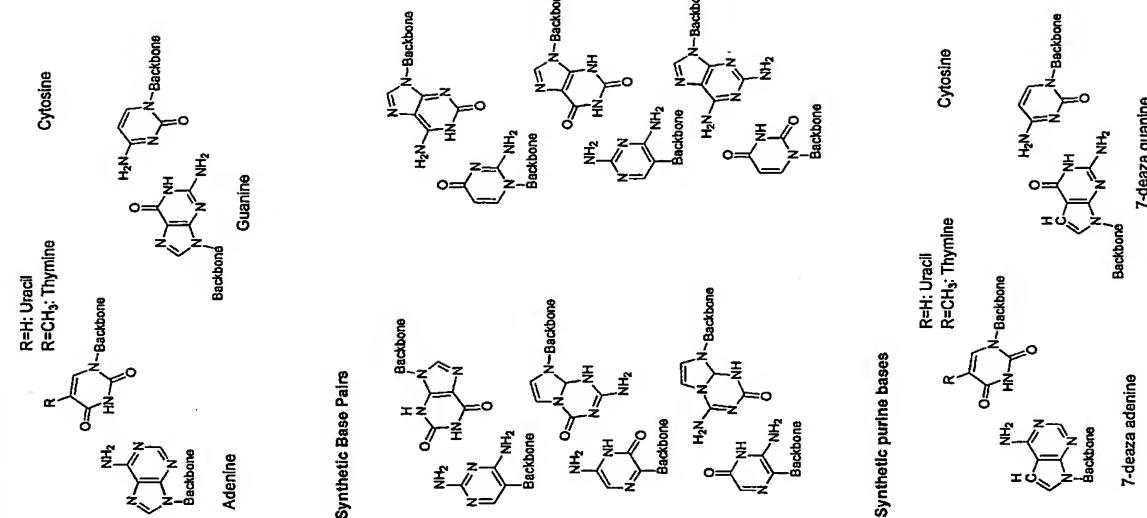


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SUBSTITUTIVE SHEET (B) (I) E 26)

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5 ky), aryl, and heteroaryl, said group being substituted with 0-3 R⁶ and 0-3 R⁹, or selected among the group consisting of C₁-C₃ alkylene-NR⁴, C₁-C₃ alkylene-NR⁴C(O)R⁸, C₁-C₃ alkylene-NR⁴C(O)OR⁸, C₁-C₂ alkylene-O-NR⁴, C₁-C₂ alkylene-O-NR⁴C(O)R⁸, and C₁-C₂ alkylene-O-NR⁴C(O)OR⁸ substituted with 0-3 R⁹.

10 19. A compound according to claims 1 to 18, wherein the **Functional entity precursor** is H or selected among the group consisting of C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkylnyl, C₂-C₆ alkadienyl, C₃-C₇ cycloalkyl, C₃-C₇ cycloheteroalkyl, aryl, and heteroaryl, said group being substituted with 0-3 R⁶ and 0-3 R⁹.

15 20. A compound according to any of the claims 1 to 19, wherein **Functional entity precursor** is selected among the group consisting of C₁-C₃ alkylene-NR⁴, C₁-C₃ alkylene-NR⁴C(O)R⁸, C₁-C₂ alkylene-NR⁴C(O)OR⁸, C₁-C₂ alkylene-O-NR⁴C(O)R⁸ and C₁-C₂ alkylene-O-NR⁴C(O)OR⁸ substituted with 0-3 R⁹.

20 21. A library of compounds according to any of the claims 1 to 20, wherein each different member of the library comprises a complementing element having a unique sequence of nucleotides, which identifies the functional entity.

25 22. A method for transferring a functional entity to a recipient reactive group, comprising the steps of providing one or more building blocks according to any of the claims 1 to 20, contacting the one or more building blocks with a corresponding encoding element associated with a recipient reactive group under conditions which allow for a recognition between the one or more complementing elements and the encoding elements, said contacting being performed prior to, simultaneously with, or subsequent to a transfer of the functional entity to the recipient reactive group.

30 23. The method according to claim 22, wherein the encoding element comprises one or more encoding sequences comprised of 1 to 50 nucleotides and the one or more complementing elements comprise a sequence of nucleotides complementary to one or more of the encoding sequences.

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24. The method of claims 22 or 23, wherein the recipient reactive group is an amine group, which may be part of a chemical scaffold, and the linkage between the functional entity precursor and the scaffold is of the general chemical structure:

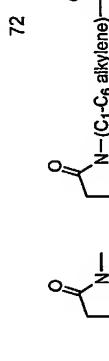
5 **Scaffold-NH-X(-V)-Functional entity precursor**

In which

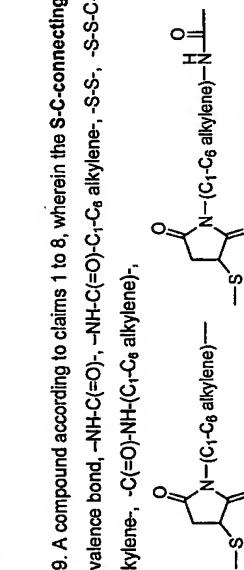
X = -C-, -S-, -P-, -S(O)-, or -P(O)-, and

V = O, S, NH, or N-C₁-C₆ alkyl.

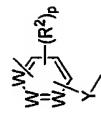
10 25. The method according to claim 24, wherein X is -C- and V is O.



5 9. A compound according to claims 1 to 8, wherein the **S-C-connecting group** is a valence bond, -NH-C(=O)-, -NH-C(=O)-C₁-C₆ alkylene-, -S-S-, -S-S-C₁-C₆ alkylene-, -C(=O)-NH-(C₁-C₆ alkylene)-,



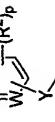
10 -NH-C(=O)-Arylene-C(R¹⁰)₂-NR¹⁰-C(=O)-, where the right hand side of the formulae connects to the carrier.



and attaches to the linker through Y, and W, Y, R², and p are as defined in claim 1. Arylene-C(R¹⁰)₂-NR¹⁰-C(=O)-, where the right hand side of the formulae connects to the carrier.

5

14. A compound according to claims 1 to 13, wherein the carrier is



and attaches to the linker through Y and

W = CH
R² = -H, halogen, -NO₂, -CN, -C(O)NR³, -C(O)NR³, -C(O)NR³,
-S(O)₂NR³, -S(O)₂NR³, -S(O)₂R³, -NTR³, wherein halogen is selected from the group consisting of -Cl, -F, -Br, and I, p is an integer of 0 to 3, and R³ = H, C₁-C₆ alkyl, or aryl,
Y = absent, C₁-C₆ Alkylen, or carbonyl.

10 10. A compound according to claims 1 to 9, wherein the **S-C-connecting group** is -S-S-, -C₁-C₆ alkylene-S-S-, -C(=O)-NH-(C₁-C₆ alkylene)-, -C(=O)-, or -C(=O)-Arylene-C(R¹⁰)₂-NR¹⁰-C(=O)-, where the right hand side of the formulae connects to the carrier.

15 11. A compound according to claims 1 to 10, wherein the **S-C-connecting group** is -S-S-, -C(=O)-, or -C(=O)-Arylene-C(R¹⁰)₂-NR¹⁰-C(=O)-, where the right hand side of the formulae connects to the carrier.

20 12. The compound according to any of the claims 1 to 11, wherein the **S-C-connecting group** is a valence bond, -NH-C(=O)-, -S-S-, or -C(=O)-NH-, where the right hand side of the formulae connects to the carrier.

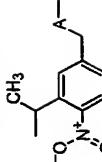
25 13. A compound according to claims 1 to 12, wherein the carrier is

17. A compound according to any of the claims 1 to 16, wherein Complementing element is a sequence of nucleotides selected from the group of DNA, RNA, LNA PNA, morpholine derivatives, or combinations thereof.

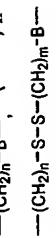
18. A compound according to any of the claims 1 to 17, wherein the **Functional entity precursor** is H or selected among the group consisting of a C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkylnyl, C₄-C₆ alkadienyl, C₃-C₇ cycloalkyl, C₃-C₇ cyclohexenoal-

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3. The compound according to claim 1, wherein the spacer is $C_1\text{-}C_6$ alkylene-A-, $C_1\text{-}C_6$ alkenylene-A-, $C_2\text{-}C_6$ alkynylene-A-, or



said spacer optionally being connected through A to a moiety selected from



where A is $-C(O)NR^1$, or -S-, $-NR^1$, or $-C(O)NR^1$, and connects to S-C-connecting group; R' is selected independently from H, $C_1\text{-}C_6$ alkyl, $C_1\text{-}C_6$ alkylenaryl, or aryl; and n and m independently are integers ranging from 1 to 6.

10

4. The compound according to claim 1, wherein spacer is -A-, a group $C_1\text{-}C_6$ alkylene-A-, $C_2\text{-}C_6$ alkenylene-A- optionally substituted with 1 to 3 hydroxy groups, or



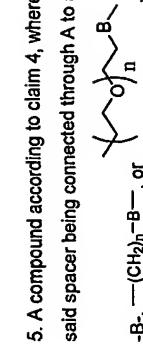
said spacer being connected through A to a linker selected from



where A is a valence bond, $-NR^{10}$, $-C(O)NR^{10}$, $-NR^{10}\text{-}C(O)$, -O-, -S-, $-C(O)O$ - or $-OP(O)O$; B is a valence bond, -O-, -S-, $-NR^{10}$, $-C(O)NR^{10}$, and connects to S-C-connecting group; R' is selected independently from H, $C_1\text{-}C_6$ alkyl,

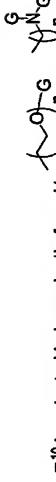
alkyl, $C_3\text{-}C_7$ cycloalkyl, aryl, $C_1\text{-}C_6$ alkenylene-aryl, $C_1\text{-}C_6$ alkylene-aryl, $C_1\text{-}C_6$ alkylene-alkyl, $C_1\text{-}C_6$ alkylene-alkylene-aryl, $C_1\text{-}C_6$ alkylene-alkylene-alkyl, and n and m independently are integers ranging from 1 to 10.

5. A compound according to claim 4, wherein the spacer is $C_2\text{-}C_6$ alkenylene-A-, said spacer being connected through A to a moiety selected from



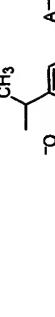
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where A is a valence bond, $-C(O)NR^{10}$, $-NR^{10}\text{-}C(O)$, -S-, $-C(O)O$ - or $-OP(O)O$; B is a valence bond, -S-, $-NR^{10}$, or $-C(O)$ and connects to S-C-connecting group; n and m independently are integers ranging from 1 to 10 and

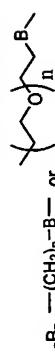


R' is selected independently from H, $\text{--}(CH2)_n\text{G}$ or $\text{--}(CH2)_m\text{G}$, wherein G is H or $C_1\text{-}C_6$ alkyl; and the spacer is connected to the complementing element through a nucleobase.

6. A compound according to claim 4, wherein the spacer is -A-,



said spacer being connected through A to a moiety selected from



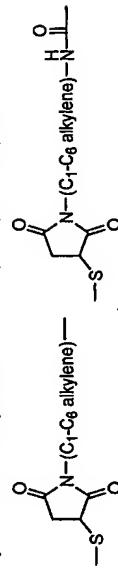
where A is a valence bond, $-NR^{10}\text{-}C(O)$, -O-, or -S-, B is a valence bond, -S-, $-NR^{10}$, or $-C(O)$ and connects to S-C-connecting group; n and m independently are integers ranging from 1 to 10 and



R' is selected independently from H, $\text{--}(CH2)_n\text{G}$ or $\text{--}(CH2)_m\text{G}$, wherein G is H or $C_1\text{-}C_6$ alkyl; and the spacer is connected to the complementing element via a phosphorus group.

7. A compound according to claim 6, wherein the phosphorus group is a phosphate or thiophosphate group attached to a 3' or 5' end of a complementing element.

8. A compound according to claims 1 to 7, wherein the S-C-connecting group is a valence bond, $-NH-C(=O)-$, $-NH-C(=O)-C_1\text{-}C_6$ alkylene-, $-SS-$, $-S-SC_1\text{-}C_6$ alkylene-, $-C_1\text{-}C_6$ alkylene-S-S-, $-C(=O)NH-(C_1\text{-}C_6$ alkylene)-,



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